BIENNIAL REPORT

OF THE

NORTH CAROLINA BOARD OF HE

TO THE

GENERAL ASSEMBLY OF NORTH CAROLINA,

SESSION 1887.

RALEIGH:
P. M. HALE, STATE PRINTER AND BINDER.
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MEMBERS OF THE BOARD.

J. W. JONES, TARBORO, *President*	Term expires		1889.
THOMAS F. WOOD, M. D., WILMINGTON, *Secretary*	"	"	1891.
R. L. PAYNE, M. D., LEXINGTON	"	"	1887.
JOHN McDONALD, M. D., WASHINGTON	"	"	1889.
RICHARD H. LEWIS, M. D., RALEIGH *	"	"	1887.
W. D. HILLIARD, M. D., ASHEVILLE	"	"	1891.
ARTHUR WINSLOW, C. E., RALEIGH	"	"	1887.
PROF. W. G. SIMMONS, WAKE FOREST	"	"	1887.
SAM'L H. LYLE, M. D., FRANKLIN	"	"	1887.

* Elected to fill the unexpired term of Dr. Whitehead.

COMMITTEES.

Epidemics—DRS. WOOD AND JONES.

Water Supply and Drainage—DR. WOOD AND MR. WINSLOW.

Hygienics of Public Schools—DRS. HILLIARD AND LYLE.

Illuminating Oils—PROF. SIMMONS.

Climatology—DR. JONES.

Adulteration of Foods and Medicines—DRS. PAYNE AND MCDONALD.

Vital Statistics—DRS. LEWIS AND WOOD.

Sanitary Inspection—DRS. JONES AND PAYNE.

STATE OF NORTH CAROLINA,

STATE BOARD OF HEALTH,

WILMINGTON, December 31, 1886.

His Excellency, ALFRED M. SCALES, *Governor:*

SIR:—In accordance with Section 2 of the "Act Relating to the Board of Health," I have the honor to present this, the first biennial report of the North Carolina Board of Health, under the amended law, ratified in the General Assembly on the 9th day of March, A. D. 1885.

Very respectfully,

Your obedient servant,

THOMAS F. WOOD, M. D.,

Secretary and Treasurer.

AN ACT

RELATING TO THE BOARD OF HEALTH.

The General Assembly of North Carolina do enact:

SECTION 1. That the Medical Society of North Carolina shall choose from its members, by ballot, six members, and the Governor shall appoint three other persons (one of whom shall be a civil engineer), and these shall constitute the "North Carolina Board of Health."

SEC. 2. That the "North Carolina Board of Health" shall take cognizance of the health interests of the citizens of the State; shall make sanitary investigations and inquiries in respect to the people, employing experts when necessary; shall investigate the causes of diseases dangerous to the public health, especially epidemics; the sources of mortality; the effects of locations, employments and conditions upon the public health. They shall gather such information upon all these matters, for distribution among the people, with the especial purpose of informing them about preventable diseases. They shall be the medical advisers of the State, and are herein specially provided for, and shall advise the government in regard to the location, sanitary construction and management of all public institutions, upon application of the proper authorities, and shall direct the attention of the State to such sanitary matters as in their judgment affect the industry, prosperity, health and lives of the citizens of the State. The secretary of the board shall make biennially to the General Assembly, through the Governor, a report of their work.

SEC. 3. The members of the Board of Health as elected by the State Medical Society shall be chosen to serve, two for six-

years, two for four years, and two for two years. Those appointed by the Governor shall serve for two years. In case of death or resignation the Board shall elect new members to fill the unexpired term.

SEC. 4. The State Board shall have a president and secretary, who shall be treasurer, to be elected from members comprising the board. The president shall serve two years, and the secretary and treasurer six years. The secretary and treasurer shall receive such yearly compensation for his services as shall be fixed upon by the Board, but the other members of the Board shall receive no pay except that while on actual duty at meetings of the Board, or on duty during the time special investigations are being pursued, each member shall receive four dollars a day and necessary traveling expenses. These sums shall be paid by the treasurer on duly authenticated requisitions signed and approved by the president of the Board.

SEC. 5. There shall be an auxiliary board of health in each county in the State. These boards shall be composed of the physicians who shall have complied with the laws of the State in regard to the practice of medicine and surgery, or have a diploma from a regular medical college, the mayor of the county town, chairman of the board of county commissioners, and the city surveyor, where there is such an officer, otherwise the county surveyor. From this number one physician shall be chosen by ballot to serve two years, with the title of superintendent of health. His duties shall be to gather vital statistics upon a plan designated by the State Board of Health. He shall make the medico-legal *post mortem* examinations for coroner's inquests and attend to prisoners in jail, poor-house, house of correction, and make examination of lunatics for commitment. He shall be the sanitary inspector of the jail and poor-house of his county, making monthly reports to the board of county commissioners. His reports shall be made regularly as advised by the State Board, through their secretary, and he shall receive and carry out as far as practicable such work as may be directed by the State Board of Health: *Provided*, that if it is impracticable to

get a county superintendent for any cause, then any one whose duty it is to provide such service may employ any member of the county board of health to do anything required by this section.

SEC. 6. The salary of the county superintendent of health shall be paid out of the county treasury upon requisition and the proper vouchers as follows: The salary of superintendent of health, or any other member of the board who is required to do the services assigned him, shall be such sum as the county commissioners shall deem just and proper for his services as physician to the public, charitable and penal institutions of the country.

SEC. 7. The biennial meeting of the election of officers shall, after the meeting of organization, be for the county boards on the first Monday in January, and of the State Board of Health on the second day of the annual meeting of the Medical Society of North Carolina.

SEC. 8. Monthly returns of vital statistics upon a plan to be made by the county superintendent of health, and a failure to report by the tenth of the month of the preceding month shall subject the delinquent to a fine of one dollar for each day of delinquency, and this amount shall be deducted from the salary of the superintendent by the board of county commissioners, on authenticated statement of such delinquency by the secretary of the State Board of Health.

SEC. 9. Inland quarantine shall be under the control of the county superintendent of health, who, acting by the advice of the local board, shall see that diseases dangerous to the public health, viz.: small-pox, scarlet fever, yellow fever and cholera, shall be properly quarantined or isolated at the expense of the city, or town, or county in which they occur. Any person violating the rules promulgated on this subject shall be deemed guilty of a misdemeanor, and upon conviction thereof shall be fined or imprisoned at the discretion of the court. In case the offender be stricken with disease for which he is quarantinable, he will be subject to the penalty on recovery, unless in the opinion of the superintendent it should be omitted. Quarantine of

ports shall not be interfered with, but the officers of the local and State boards shall render all the aid in their power to quarantine officers in the discharge of their duties, upon the request of the latter.

SEC. 10. Whenever and wherever a nuisance upon premises shall exist, which, in the opinion of the county superintendent of health, is dangerous to the public health, it shall be his duty to notify in writing the parties occupying the premises (or the owner, if the premises are not occupied), of its existence, its character and the means of abating it. Upon this notification the parties shall proceed to abate the nuisance, but failing to do this shall be adjudged guilty of a misdemeanor, and shall pay a fine of one dollar a day, dating from twenty-four hours after the notification has been served, the amounts so collected to be turned over to the county treasurer: *Provided, however*, that if the party notified shall make oath or affirmation before a magistrate of his or her inability to carry out the directions of the superintendent, it shall be done at the expense of the town, city or county in which the offender lives. In the latter case the limit of the expense chargeable to the city, town or county shall not be more than one hundred dollars in any case: *Provided, further*, that nothing in this section shall be construed to give the superintendent the power to destroy or injure property without a due process of law, as now exists for the abatement of nuisances.

SEC. 11. Vaccination: On the appearance of a case of smallpox in any neighborhood, all due diligence shall be used by the superintendent of health that warning shall be given, and all persons not able to pay, shall be vaccinated free of charge by him, and the county superintendent shall vaccinate every person admitted into a public institution (jail, poor-house, public school) as soon as practicable, unless he is satisfied, upon examination, that the person is already successfully vaccinated. The money for vaccine to be furnished by the county commissioners.

SEC. 12. Bulletins of the outbreak of disease dangerous to the public health shall be issued by the State Board, whenever

necessary, and such advice freely disseminated to prevent and check the invasion of disease into any part of the State. It shall also be the duty of the Board to inquire into any outbreak of disease by personal visits or by any method the Board shall direct. The compensation of members on such duty shall be four dollars a day and all necessary traveling expenses.

SEC. 13. Special meetings of the State Board of Health may be called by the president through the secretary. The regular annual meetings shall be held at the same time and place of the State Medical Society, at which time the secretary shall submit his annual report.

SEC. 14. Analyses for purposes connected with the hygienic duties of the superintendent of health shall be made by the chemist of the Agricultural Station upon requisition signed, approved by the secretary of the State Board of Health. Such analyses will include soil, drinking water, articles of food, &c., to be packed for transmission by direction of the Chemist of the Agricultural Station.

SEC. 15. For carrying out the provisions of this act, two thousand dollars, or so much thereof as may be necessary, are hereby annually appropriated, to be paid on requisition signed by the treasurer and president of the State Board of Health, and the printing and stationery necessary for the Board to be furnished upon requisition upon the public printer, which shall not exceed two hundred and fifty dollars annually. A yearly statement shall be made to the State Treasurer of all moneys received and expended in pursuance of this act.

SEC. 16. A contingent fund of two thousand dollars is hereby appropriated, subject to the Governor's warrant, countersigned and recorded by the Auditor of the State, to be expended in pursuance of the provisions of this act when rendered necessary by a visitation of cholera or any other pestilential disease.

SEC. 17. All previous acts conflicting with this act are hereby repealed upon the passage of this act.

SEC. 18. This act is in force from and after its ratification.

In the General Assembly read three times, and ratified this the 9th day of March, A. D. 1885.

The Board began its work under the amended laws in March, 1885, being composed of Drs. J. W. Jones, Tarborough, President; R. L. Payne, Lexington; S. S. Satchwell, Rocky Point; John McDonald, Washington; Richard H. Lewis, Raleigh; Samuel H. Lyle, Franklin; Arthur Winslow, C. E., Raleigh; Prof. W. G. Simmons, Wake Forest; and Dr. Thomas F. Wood, Wilmington, Secretary. Of these, Dr. S. H. Lyle, Prof. W. G. Simmons and Mr. Arthur Winslow were appointed by the Governor, and Dr. Richard H. Lewis was elected to the vacancy caused by the death of Dr. Whitehead.

The first duty was that of reorganization of county boards of health and of stimulating new organizations in those counties where none existed. The object of county boards of health is not only to get reports of the condition of health and of prevailing diseases dangerous to public health in the various counties, but to get frequent inspections of the public buildings of the counties, in order that the public might know in what way these institutions are conducted; and in so doing they utilize the services of the public officer—the county superintendent of health—who being physician to the county—an indispensable office—had added to his work that of a public hygienist.

At the time of the meeting of the reorganization of the State Board, held in Raleigh on the 20th–21st of March, 1885, there were no counties sending in regular reports save, perhaps, New Hanover. At the time of this report there are fifty. By this organized machinery in the ninety-six counties of the State, the good to result from practical inspections of the public health would be greatly enhanced. The growth of such work is necessarily slow, but it has been much slower than we would have supposed, seeing that the law specifies how county boards *shall be* established and sets forth this very plainly as the way of supplying medical service to a county.

Sec. 5 of the act says: "There shall be an auxiliary board of health in each county in the State. These boards shall be composed of the physicians who shall have complied with the laws of the State in regard to the practice of medicine and surgery,

or have a diploma from a regular medical college, the mayor of the county town, chairman of the board of county commissioners, and the city surveyor, where there is such an officer, otherwise the county surveyor. From this number one physician shall be chosen by ballot to serve two years, with the title of superintendent of health. His duties shall be to gather vital statistics upon a plan designated by the State Board of Health. He shall make the medico-legal *post mortem* examinations for coroner's inquests, and attend to prisoners in jail, poor-house, house of correction, and make examination of lunatics for commitment. He shall be the sanitary inspector of the jail and poor-house of his county, making monthly reports to the board of county commissioners. His reports shall be made regularly as advised by the State Board, through their secretary, and he shall receive and carry out, as far as practicable, such work as may be directed by the State Board of Health: *Provided*," etc.

By comparison of the reports which have been received from various parts of the State, it will be seen how varied has been their nature, but it will also be observed that they have improved in quality as well as increased in numbers; but much is still to be desired in both directions.

For some time the old form of report was used embracing weather reports and school statistics, but as the latter of these was regarded as unnecessary each month, it was thought better to adopt a more simple form, consisting of reports on the existence of contagious diseases, on epidemics among men and animals, on the number of inmates in poor-house, jail and house of correction, with the number of cubic feet of space allotted each, the quality and quantity of food and water served each, the number which have been vaccinated, and the number which can read and write, and remarks on the sanitary condition of county and public buildings.

This form was adopted and put into use in March of 1886, and since then the reports have been more full and accurate. Special blanks for reports on the sanitary condition, etc., of school-houses and their surroundings will be sent once, or, if

that is found insufficient, twice each year with questions to be answered by the superintendent of schools in each county.

In lieu of the weather reports from county superintendents of health, which are but meagre and inaccurate at their best, Prof. Simmons, through the courtesy of General Hazen, of the United States Signal Service Bureau, receives monthly reports from Smithville, Hatteras, Fort Macon, Kitty Hawk and Wilmington, on the coast; from Knoxville, Tenn., which answers to the western part, and from Charlotte and Lynchburg, Va., for the central portion of the State. These, with the report of Prof. J. W. Gore, at Chapel Hill, and his own observations, taken at Wake Forest, make a total of ten stations in different portions of the State. These reports are full and accurate and give a very good general idea of the weather all over the State, though it would be much better could the number of stations be increased to two or three times the present number. Could voluntary observers be found, and we have no doubt there could, the money would be well spent were the State to furnish instruments for the establishment of twenty or twenty-five stations in different parts of the State for use by the Board of Health and Agricultural Department conjointly.

An attempt was made to obtain vital statistics from those counties reporting to the State Board, but it was found impossible to obtain them of any value as there is no law compelling physicians to report births and deaths, and I regret that this effort has shown that their interest in the welfare of the State will not cause them to give this information voluntarily. A complete and accurate registration of every marriage, birth and death is absolutely necessary to those to whom the health of a State, a county, or a city or town is entrusted, if they would effect any real progress in the science of public hygiene. The object and work of the Board of Health is to "take cognizance of the health interests of the citizens of the State;" to "investigate the causes of diseases dangerous to the public health, especially epidemics; the *sources of mortality;* the effect of locations, employments and conditions of public health;" and how can they

do this without a complete registration of vital statistics? How can they "gather such information upon all these matters, for distribution among the people, with the especial purpose of informing them about preventable diseases" without such registration?

The health of its subjects and the average duration of their lives, is to every government a matter of the highest consideration. And to be indifferent to, or ignorant of the laws which affect human nature, would be to make the legislator responsible for the ravages of every preventable epidemic of disease. But how shall the legislator or government of our State be able to act intelligently or effectually in relation to public health? In no other way, we emphasize, is it possible than by an adequate knowledge of our vital statistics; to be derived alone through uniform and careful registration, by which not only are the causes of disease and death ascertained, but the proportion of death-rate to the population, and to the occupation of those who died—knowledge of no secondary importance.

A majority of the States have enacted laws requiring the registration of births, deaths and marriages, and in those States in which these laws have existed the longest do they meet with the most popular favor, as is evidenced by the increased appropriations which are cheerfully made for the perfection of these records.

The reports on public buildings have brought to the eyes of the community a disgraceful state of affairs in many counties in the State. Sanitarians place the proper amount of space per capita, for health, at eight hundred cubic feet; and with even this amount the ventilation should be such as to permit frequent renewal of the air. In the county jails it is the exception when this condition exists, in very many the number of cubic feet falling below half the requisite, and it has been known to be *below one hundred.* We are glad to state, however, that the efforts of the superintendents have, in several instances, caused the improvement of some of these conditions. The food and water served the inmates of jails and poor-houses have generally been reported

good and sufficient. In many cases the buildings seem constructed only with a view to occupancy in summer, there being no adequate arrangements made for heating. By reference to the tables showing the condition of jails and poor-houses it will be seen that a much larger per centage of the inmates of the jails than of the poor-houses can read and write.

The condition of the jails throughout the State is much to be regretted, and the deaf ear which is turned to the suggestions of the superintendents of health, as to advisable and frequently necessary improvements, shows how essential is some State supervision of public prisons. There can be but little doubt that much of the disease, which renders unfit for the work they have to do the convicts sent to the State Penitentiary, and swells to such ugly proportions the death-rate among them, has its origin in the county jails in which these men—human creatures—have to be confined, their numbers increasing and their room proportionately decreasing, till the *welcome sentence* of the District Judge releases them from the living death to which they have been subjected, and sends them to the more sanitary surroundings in the Penitentiary.

An attempt was made to have each prisoner sent to the Penitentiary examined by the superintendent of health of the county from which he was sent, and furnished with a descriptive list to be given to the officer in charge of the Penitentiary. This list was to show the prisoner's condition at the time of his entering and leaving the county jail, and was to serve both as a guide to the Penitentiary officials in the disposition of said prisoner, and as a check on the county authorities for the treatment he had received while in their keeping. This attempt, however, proved an utter failure. In only two or three instances did the county commissioners order it done, and those who did would allow no extra fee to the superintendents, and the work being of such a disgusting and filthy nature, the latter were unwilling to perform it without some remuneration. At the regular meeting of the Board in New Bern a committee was appointed to confer with the Board of Directors of the Penitentiary, and get them to have

a thorough physical examination made by the physician in charge, of each prisoner on his first arrival at the Penitentiary. This examination was deemed more necessary by the Board as it appeared from the reports of the physicians in charge of the stockades, copies of these reports being furnished the Board, that men were sent to the stockades in whom heart, lung, or other constitutional diseases in a more or less severe form already existed, rendering them unfit for the kind of work they were compelled to do. The result of this conference appears in the report of the committee.

During the past two years committees from this Board have made, upon invitation from the officers in charge, visits of inspection to the different State institutions and to the convict camps in the western part of the State. Reports of these inspections have been submitted to this Board and accompany this report. Copies were sent, at the time of the inspections, to the officers in charge of the different institutions and to the Governor.

At the meeting in New Bern, Dr. Richard H. Lewis read a paper on the "Care of the Eyes and Ears." This paper was stereotyped and 5,000 copies printed and distributed among the people of the State. The stereotyped plates are preserved so that, when necessary, any additional number can be issued at but slight expense above the cost of paper and press-work.

The Board has also published the 3d edition (1,000 copies) of "Sanitary Engineering," by Wm. Cain, C. E., which he kindly revised and enlarged during his summer vacation. About five hundred of these have been distributed.

In April, 1886, the Board commenced the publication of a monthly "Bulletin," which gives each month the nature of diseases prevailing during the preceding month in those counties reporting to the State Board; the condition of the jails and poor-houses in those counties; the meteorological reports from the ten stations in the State, and such other information and advice for the advancement of the public health as may come to the attention of the Board. On account of the smallness of our printing fund the size of this publication is much smaller than

the needs of the people and the information which is constantly coming before the Board, and which should be given to the people, would suggest. The copies issued are also restricted to a much smaller number than should be the case, the number at present being but six hundred and fifty, and even with this small circulation, the printing fund will be more than consumed, and the Board will have to make good this deficit out of the appropriation, which is sorely needed for and should be devoted to other uses. But this information must be furnished the people, if the object for which the Board of Health was created—the instruction of the people in the science of public hygiene and the promotion of the health interests of the State—is to be accomplished; and small as it is, both in size and circulation, we feel convinced that much good has resulted from it, not only in the information it has spread over the State, but in stimulating county superintendents in their work, and in influencing the organization of boards of health in several counties where none existed before. We believe that in thus publishing the condition of public buildings, and bringing before the people the criminal neglect of and utter disregard for the health and comfort of the inmates of these institutions on the part of the county officials, much has been and will continue to be done in the improvement of these conditions.

The Board is gratified at the improved condition of the public health of the State during the past two years, very many counties reporting a better condition in that regard than for many years. No case of cholera, small-pox or yellow fever has come to the knowledge of this Board as having occurred in the State—imported or otherwise—and the special epidemic appropriation of two thousand dollars has not been touched. There is great need, however, of better facilities for the disinfection of vessels at the quarantine station at Smithville, and for the isolation and care of any cases of contagious disease which may be brought there. To accomplish this, there should be erected hospital accommodations for any cases of infectious disease which may enter the river on board of ships or steamers. At present the port of Wilmington is entirely without any means of caring for seamen

sick with yellow fever, small-pox or cholera, any one of which diseases may be discovered by the quarantine physician at Smithville on incoming vessels. It is needless to say that the care of such sick persons cannot be had on shipboard, nor would it be humane to detain them on the vessel, at the risk of their own lives and the lives of those on the same vessel with them. The Marine Hospital, under the control of the United States government, cannot admit such cases to their wards, for evident reasons, and thus provision for any such emergency must be made by the State. The board of quarantine for the port of Wilmington need this help, and will be glad to suggest plans for buildings to meet the wants of the station. The ground for the hospital is already in the possession of the State; the buildings can be erected and made comfortable for a comparatively small sum. The plans for the hospital will include a keeper's house, a house for observation of the people taken from an infected ship and not sick at the time of their removal, two houses, or wards, one for small-pox and one for yellow fever or cholera, a small room for the disinfection of clothing and articles likely to carry the disease to the city of Wilmington and thence into the State at large, and a cistern for a supply of water sufficient for drinking, cooking and bathing purposes. There is also great need for a wharf at the station for the safety of vessels undergoing quarantine service of disinfection. The commerce of Wilmington is constantly growing, and the danger of the importation of disease is proportionately increased, as vessels enter the port from every quarter of the globe.

The present method of securing disinfection and cleansing of vessels is not equal to the demands that the quarantine authorities may be called on any day to meet, for the safety of the State as well as the chief commercial town in her borders.

At the regular meeting of the Board, held in New Bern, in May, 1886, Prof. W. G. Simmons made a partial report on "Illuminating Oils." He had not been able to complete his report, and asked for further time. His experiments on twelve samples of oil obtained from the retail dealers of Wake Forest, showed the class of oil sold there to be far below what is neces-

sary for safety. Using the "Oil Tester of the New York Board of Health," he found several of these oils to "flash" below 100° F., he placing the minimum safety point at 112° F I quote from a letter just received from Prof. Simmons giving the names and "flashing points" of these oils:

"White C" flashed at.		118°	F.
"Red C"	" "	119°	"
"Safety"	" "	115°	"
"Safety" (another mf'r.) flashed at.		117°	"
"Security" flashed at		124°	"
"Security" (another mf'r.) flashed at		130°	"
"Astral" flashed at		118°	"
Kerosene	" "	99°	"
"	" "	95°	"
"	" "	99½°	"
"	" "	99°	"
"	" "	84°	"

"I stated, at the convention at New Bern, that illuminating oils flashing at 112° F. or above that point (by the New York Oil Tester) were reasonably safe, and that I was prepared to recommend that the State Legislature be memorialized to prohibit the sale, within this State, of all illuminating oils having their "flashing points," by the Oil Tester of the New York Board of Health, below 112° F. I have since had no reason for changing this opinion or the proposed recommendation to the Legislature. Indeed, I think such legislation is becoming more important every year. Several of the northern and northwestern States have enacted penal statutes on this subject, and the result has been to cause the best and safest oils to be put on the market in those States, while the unsafe oils have all been sent to the States having no penal legislation on the subject."

He regrets that the press of business at the college has prevented the completion of his report in time to present to the Legislature. It will be read at the regular meeting of the Board, at Charlotte, in April, of 1887, and will appear either *verbatim* or in a condensed form in the "Bulletin."

The state of things found in Wake Forest would undoubtedly be found at any and every other point in the State. The fact that low-grade oils are crowded into this and other Southern States, being driven from most of the Northern States by the stringent laws which prohibit the sale of oils below a certain standard in those States, is so evident that it was made a matter for comment in a recent text-book on "Illuminating Oils."

It is true that many of the casualties from kerosene oil are due to carelessness, but I believe that three-fourths of these disasters would be prevented could these dangerous low-grade oils be kept out of the State. It is useless to try to prevent their sale by informing the people of their danger. As long as people can buy oil at ten or twelve cents per gallon, they will not pay twenty for it. Better would it be, if they cannot afford to buy the higher grades of oil, that they return to the primitive tallow candle and pine-knot, than that so many thousands of lives and so much property should be daily jeopardized by the use of this dangerous stuff.

I hope that the legislators of the State will, at an early date, carry out the recommendations of Prof. Simmons, and enact laws which will drive out from our borders this cause of most horrible death. It is a matter which affects us all, for if our neighbor is careless, we cannot feel ourselves secure, no matter how careful we be.

In January, 1886, circular letters were sent to the proper authorities in each county in the State, asking for the number of insane, in confinement or at liberty, on the 1st of January, 1886. Of the ninety-six counties to which these letters were addressed replies were received from only thirty-one, with the result as shown in the following table:

COUNTIES.	White.	Colored.	Total.	PLACE OF CONFINEMENT.
Beaufort	...	2	2	Poor-house.
Bladen	1	...	1	Not confined.
Brunswick	1	...	1	Jail.
Buncombe	2	...	2	Alms-house.
Caldwell	6	1	7	Generally at home—close rest'nt.
Chatham	14	3	17	Poor-house, 4; not confined, 13.
Cleveland	1	...	1	At home.
Columbus	2	...	2	Jail, 1; Poor-house, 1.
Cumberland	6	...	6	Poor-house, 5; Jail, 1.
Davidson	4	...	4	Jail, 2; Poor-house, 2.
Durham	1	1	2	Poor-house.
Forsyth	2	1	3	Poor-house.
Franklin	...	...	...	.....
Graham			1	Morganton.
Greene	3	2	5	Not confined.
Guilford	...	...	...	.....
Halifax	2	2	4	Jail, 2; Poor-house, 2.
Iredell	6	1	7	Poor-house, 4; not confined, 3.
Johnston	1	...	1	Poor-house.
Lincoln	6	1	7	Poor-house.
McDowell	2	...	2	At home.
Macon	3	...	3	Not confined.*
Mecklenburg	10	10	20	.....
New Hanover	2	4	6	Poor-house.
Onslow	...	...	...	.....
Person	9	5	14	Poor-house.
Rowan	3	...	3	Poor-house.
Rutherford	4	...	4	Jail, 2; Poor-house, 2.
Tyrrell	1	2	3	Not confined.
Vance	2	2	4	At home, 2; not confined, 2.
Yadkin	3	...	3	....
Number of counties.....31	98	37	135	

* Race not given.

Taking these reports as an average of all the counties, it would show that there are 370 insane in the State who are not taken care of by the State.

Seeing the necessity for prompt information of contagious diseases occurring in neighboring States, the International Conference of State Boards of Health, at Toronto, Canada, October 6th, 1886, adopted the following resolutions concerning "Inter-State Notification in Infectious and Contagious Diseases," which were also presented to and adopted by the American Public Health Association, on October 8th, 1886:

WHEREAS, It is necessary for the protection and preservation of the public health that prompt information should be given of the existence of cholera, yellow fever and small-pox; be it

1. *Resolved*, That it is the sense of the National Conference of State Boards of Health that it is the duty of each State, Provincial and Local Board of Health in any locality in which said diseases may at any time occur, to furnish immediately information of the existence of such disease to boards of health of neighboring and provincial States and to the local board in such States as have no State board.

2. *Resolved*, That upon rumor or report of the existence of pestilential disease, and positive definite information thereon not being obtainable from the proper health authorities, this Conference recommends that the health officials of one State shall be privileged and justified to go into another State for the purpose of investigating and establishing the truth or falsity of such reports.

3. *Resolved*, That whenever practicable, the investigations made under the preceding section shall be done with the co-operation of the State or local health authorities.

4. *Resolved*, That any case which presents symptoms seriously suspicious of one of the aforenamed diseases shall be treated as suspicious and reported as provided for in cases announced as actual.

5. *Resolved*, That any case respecting which reputable and experienced physicians disagree as to whether the disease is or is not pestilential shall be reported as suspicious.

6. *Resolved*, That any case respecting which efforts are made to conceal its existence, full history and true nature shall be deemed suspicious and so acted upon.

7. *Resolved*, That in accordance with the provisions of the foregoing resolutions, the Boards of Health of the United States and Canada represented at this Conference do pledge themselves to an interchange of information as herein provided.

As the water taken into our systems is second in importance only to the air we breathe, the water supply should be made the subject of careful study and examination by both corporations and individuals. It is to be regretted that our State is so backward in this matter of such vital importance to the health of her citizens. Articles on drinking water have from time to time appeared in the Bulletin, and the State has made provision for the analysis of suspected water by the State Chemist. Notwithstanding this fact, and though permits for analyses, with instructions for preparing and shipping samples of water, are furnished by this Board to any one making application therefor to the Secretary, only twelve analyses of water have been made under instructions from this Board during the two years just past. The

subject of drinking water is one which is, and has been for some time, attracting the attention of sanitarians as one of the commonest and most persistent sources of disease and death with which we have to combat. In several epidemics of typhoid fever in Pennsylvania during the past year the cause was found, by careful investigation on the part of the Board of Health of that State, to lie in the contamination of drinking water, while in Massachusetts 393,000 cases of typhoid fever and 40,000 deaths were traced to the same source.

The President of this Board has undertaken to collect statistics in regard to drinking water in different sections of the State, with a view to reading a paper on this subject, at the next annual meeting of the Board, in Charlotte, and the Board hopes in its next report to show a greater extent of good accomplished in this direction than has been the case during the two last years. But the greatest amount of good in this matter cannot be accomplished until there is adopted some system of house-to-house inspection in every city and town in the State.

As illustrative of the work done in other States and the benefit to be derived from these inspections, I quote from the report of the Secretary of the Illinois State Board of Health:

"The sanitary survey of the State has embraced the examination of 300,000 houses and premises, in 395 cities, towns and villages in 96 of 102 counties in the State. These inspections embraced every material condition affecting health, individual and public—site of house; its age, material, ventilation, condition, especially of basement or cellar, of cess-pools, sinks, drains, out-houses, and water-supply; of the yard and stables, barns, etc.; the vaccinal status of occupants, the occurrence of certain diseases, etc., and resulted in disclosing, in 382 places from which reports had been received at the close of the year, a total of 474,831 defective conditions and nuisances prejudicial to health, of which number 441,503, or over 90 per cent., were reported abated or remedied at the close of the year. The total cost of these inspections is estimated at about $50,000 for everything except the work actually done or caused to be done by the house-

holder, tenant or owner. In Chicago it was a little less than seventeen cents for each inspection, including pay of inspectors, wages of laborers, hire of teams, cost of disinfectants, printing, stationery, etc. The death-rate from the filth diseases in Chicago was reduced 15 per cent. last year, and the health commissioner, Dr. De Wolf, says: 'There can be no question that much of this decrease in the preventable mortality was due to the house-to-house inspection and kindred efforts which were made possible through the special appropriation in anticipation of cholera.'"

TREASURER'S REPORT.

DISBURSEMENTS.

1885.			
March	9	Stamps	$ 2 00
	20	Receipt book	50
	21	Copy of act relating to Board of Health	3 10
	22	S. S. Satchwell, expense to meeting in Raleigh	23 00
	22	R. L. Payne, " " " " "	24 00
	22	J. W. Jones, " " " " "	28 60
	22	R. H. Lewis, " " " " "	4 00
	22	Thomas F. Wood, " " " " "	25 00
	31	Secretary's salary 1st quarter, 1885	300 00
April	6	Stamps	4 00
	6	Fitting and furnishing office	125 00
	13	Stamps	2 00
	13	Express on stationery to members of board	4 50
	18	Stamps and postals	5 75
May	1	Stamps	3 25
	5	"	2 00
	13	Paper wrappers and stamps	2 55
	22	R. H. Lewis, expense meeting at Durham	19 55
	22	S. H. Lyle, " " " "	34 95
	22	W. D. Hilliard, " " " "	10 15
	22	R. L. Payne, " " " "	16 95
	22	J. W. Jones, " " " "	39 90
	22	W. G. Simmons, " " " "	19 40
	22	Arthur Winslow, " " " "	11 00
	22	Thomas F. Wood, " " " "	39 00
	22	S. S. Satchwell, " " " "	15 50
	22	R. D. Jewett, " " " "	20 50
	29	W. D. Hilliard, inspection convict camps	25 75
	29	Thomas F. Wood, " " "	72 40
June	10	Postals	50
	10	C. W. Yates, for sundries	33 30
	10	Giles & Murchison, for sundries	1 45
	12	Freight on stationery from Raleigh	60
	15	Stamps and postals	1 75
	17	Telegrams	1 35
	30	Secretary's salary 2d quarter, 1885	300 00

July	6	Express on stationery from P. M. Hale	$ 50
	18	Stamps and postals	5 83
	20	Express on map and stationery	62
Aug.	27	Stamps	2 25
Sept.	4	Stamps	1 50
	5	8 copies of "Sanitary Monitor," $1.00	8 00
	5	2 " " " Enquirer," $4.00.	8 00
	5	E. & F. N. Spou's account	9 84
	5	8 copies "The Sanitarian," $4.00	32 00
	5	Shaffer's map of North Carolina	10 00
	5	Post-office orders	52
	7	To supply 3 missing Trans. Am. Pub. H. Asso	15 10
	7	Arthur Winslow, inspection Asylum for D. D. and Blind.	32 00
	14	A. Winslow, inspection Western N. C. Insane Asylum	23 00
	14	R. H. Lewis, " " " " "	26 50
	14	Checks on New York to pay above	20
	16	Stamps	1 00
	17	Freight on stationery from P. M. Hale	1 65
	26	" " " " " "	50
	26	Stamps	2 20
	30	Secretary's salary, 3d quarter, 1885	300 00
Oct.	8	Stamps	1 00
	12	Freight on stationery from P. M. Hale	1 45
	14	P. O. box rent	1 50
Nov.	6	C. W. Yates, sundries	95
	6	Giles & Murchison, twine	20
	6	Stamps	1 45
	30	Freight and dray, "Sanitary Engineering"	2 60
Dec.	4	Stamps	1 80
	11	Stamps	1 50
	17	T. F. Wood, expense Con. of State B'ds. of H	40 00
	17	J. W. Jones, " " " " "	25 00
	20	2 volumes "Trans. Am. Pub. H. Asso."	10 00
	30	Secretary's salary 4th quarter, 1885	300 00
1886.			
Jan.	4	Express on package to Prof. Cain	45
	7	Postage "Sanitary Engineering"	8 70
	12	Stamps	75
Feb.	28	Stamps	2 15
Mar.	20	Stamps	1 25
	25	Freight on stationery from P. M. Hale	55
	27	Freight on books to A. Winslow	30
	30	Secretary's salary 1st quarter, 1886	300 00

April	7	Stamps	$ 2 00
	30	C. W. Yates, sundries	1 08
	30	Giles & Murchison, letter scales	4 50
	30	Building and painting book shelves	7 50
May	5	Stamps	2 00
	21	John McDonald, expense meeting at New Bern	22 75
	21	J. W. Jones, " " " "	29 25
	21	W. D. Hilliard, " " " "	64 00
	21	A. Winslow, " " " "	45 50
	21	W. G. Simmons, " " " "	25 00
	21	R. H. Lewis, " " " "	24 10
	21	R. D. Jewett, " " " "	17 60
	28	Stamps	50
June	16	Stamps	75
	16	Freight on "Bulletin"	45
	25	Stamps	1 00
	28	Freight on books to R. H. Lewis	25
	30	Secretary's salary 2d quarter, 1886	300 00
July	9	Stamps and postage on Bulletin	1 50
	9	J. W. Jones, inspection N. C. Insane Asylum	29 60
	9	W. G. Simmons, meteorological instruments	80 15
	14	8 copies of Sanitarian, 1886, $4.00	32 00
	14	Post-office box rent, 1886	3 00
	30	Freight on Bulletin and wrappers	1 00
Aug.	5	Stamps and postals	1 50
	13	Express on MS. "Care of Eyes and Ears" to Raleigh	40
	17	Stamps	1 00
	25	A. Winslow, inspection N. C. Insane Asylum	26 00
	27	Stamps	1 00
Sept.	13	Stamps	1 25
	20	Five copies Lamb Prize Essays (Am. P. H. Asso.)	5 00
	24	Stamps	1 00
	30	Freight on plates "Care of Eyes and Ears"	46
	30	Secretary's salary third quarter, 1886	300 00
Oct.	2	Freight on Bulletin	50
	11	Postage	1 19
	13	R. H. Lewis, postage, wrappers and freight for "Care of Eyes and Ears,"	50 00
	14	Westcott & Thomson, stereotyping "Care of Eyes and Ears"	132 45
	14	Sanitary Engineer (A. Winslow)	4 00
	14	Stamps	90
	20	Assessment Conv. State Boards of Health	5 00
	28	Stamps	1 50

Oct.	29	Freight on Reports of Michigan Board of Health to complete library	1 65
	30	Freight on bases for stereotype plates	35
Nov.	3	Westcott & Thomson, bases for stereotype plates	7 00
	3	Express on Bulletin	50
	3	Paste brush	20
	4	500 sheets cyclostyle paper	40
	8	Postage on Bulletin	42
	23	Stamps	1 00
Dec.	1	C. W. Yates	13 52
	2	Express and postage on Bulletin	75
	2	Office rent ending December, 1886, 10 months, at $5.00	50 00
	9	Stamps	1 50
	10	¼ cord wood and cutting	1 25
	16	Secretary's salary 4th quarter, 1886	300 00
	18	Freight on "Care of Eyes and Ears"	53
	24	Stamps	2 35
			$4,015 93

RECEIPTS.

Appropriation for year 1885	$2,000 00	
" " " 1886	2,000 00	$4,000 00
Balance due Thomas F. Wood, Treasurer		$15 93

TABLE SHOWING CONDITION OF POOR HOUSES FOR YEAR 1886,

IN THE COUNTIES REPORTING TO THE STATE BOARD OF HEALTH.

COUNTIES.	Number of Inmates During												Average No.			Space in Cubic Feet Allotted Each Inmate.*	General Remarks on the Sanitary Condition.
	January.	February.	March.	April.	May.	June.	July.	August.	September.	October.	November.	December.	For the year.	Vaccinated.	Which can Read and Write.		
Buncombe	22	20	20	20	30	26	26	23	22	22	20	26	23	20	17	742	Excellent.
Burke	†	†	†	†	‡	9	10	10	†	†	†	†	10	†	†	‡	Good.
Cabarrus	.....	.....	.....	.....	.....	13	12	13	13	16	14	15	14	6	9	1,665	Good.
Camden	.....	.....	.....	.....	.....	.....	.....	.....	.....	6	6	.....	.....	.....	.....	.....	Very good.
Catawba	†	20	20	18	20	20	15	13	13	16	18	18	17	9	10	300	Buildings old. New ones contemplated.
Chatham	37	‡	38	37	41	42	39	30	30	30	30	30	35	13	‡	714	Good.
Cherokee	4	3	3	3	3	5	6	5	6	5	6	6	5	‡	‡	650	Good, except an insufficiency of air.
Cleveland	32	†	31	27	28	27	27	27	27	29	30	36	29	‡	5	591	Four cottages. Estimates for improvements have been made.
Columbus	8	8	7	6	7	6	5	5	5	6	6	6	6	‡	.....	550	New building to be built soon, with latest sanitary impro'mts.
Cumberland	15	15	16	20	20	18	15	14	15	14	18	.....	16	11	6	800	Excellent condition.
Davidson	18	19	19	19	18	20	18	23	18	18	16	16	18	‡	5	720	Good. Dietary has been improved, and a nurse provided.
Duplin	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	8	.....	.....	.....	.....	Good.
Durham	6	†	9	9	17	13	8	10	6	7	5	5	9	‡	‡	‡	Good.
Edgecombe	35	34	32	32	19	19	19	19	20	23	22	.....	25	‡	‡	2,200	Excellent.
Forsyth	†	‡	16	16	14	14	18	14	18	14	†	.....	16	7	4	904	Good.
Franklin	13	13	12	13	13	13	14	14	13	14	13	12	13	10	1	850	Very good.
Gaston	8	8	9	9	8	8	8	8	8	11	13	12	9	3	3	2,580	Buildings seven in number, and very comfortable.
Greene	4	3	6	6	7	5	4	6	6	6	6	6	5	4	2	1,800	A large, airy and roomy building nearly completed.
Guilford	†	†	34	35	33	†	†	34	31	†	34	34	34	‡	‡	600	Good.
Henderson	6	9	8	6	6	6	8	†	8	†	†	.....	7	6	2	1,500	Good.
Iredell	†	15	15	17	23	16	20	‡	15	†	†	....	17	‡	‡	554	Pretty fair.
Johnston	†	10	11	11	11	10	10	10	8	9	9	16	10	‡	‡	722	Very good.
Jones	6	6	4	4	4	4	5	†	5	5	5	4	5	3	.....	980	All the houses, save one, in good condition.
Lenoir	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	[small and too frail.
Lincoln	15	17	17	15	15	13	13	13	14	‡	14	14	15	‡	‡	609	The three buildings are unsuited for this purpose, being too
McDowell	12	12	12	10	10	10	10	12	10	12	10	11	11	3	2	435	Good condition. New building just finished.
Macon	.....	†	.....	.....	.....	†	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	
Madison	.....	.....	6	5	6	6	6	6	6	6	6	6	6	.....	.....	2,100	Good.

Montgomery	.....	.....	.....	.....	.....	.....	.....	.....	.....	12	12	.....	.....	.....	.....	500	Good.
New Hanover	24	24	24	26	24	20	23	19	†	28	22	31	24	16	12	600	Good.
Northampton	†	†	†	†	†	‡	†	†	‡	‡	‡	†	.....	.....	.....	‡	
Onslow	5	5	5	5	4	4	5	5	5	5	5	8	5	.....	1	1,250	Good.
Pender	.....	.....	.....	†	5	8	11	8	9	8	8	7	8	4	2	1,220	Building unsuitable, but only temporary.
Person	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	16	.....	.....	.....	.....	1,020	Fair.
Pitt	†	†	†	18	20	18	†	19	†	22	.....	.....	.....	4	.....	.....	Good.
Polk	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	4	.....	.....	.....	.....	1,153	Needs improvement.
Richmond	†	†	10	10	10	10	10	10	10	12	12	12	11	1	2	1,650	Prison for lunatics needs improvement.
Robeson	9	8	9	9	10	10	10	9	9	9	9	8	9	‡	‡	600	Hardly comfortable in cold weather
Rowan	24	‡	23	21	20	20	19	17	17	20	27	30	22	‡	‡	400	Good.
Rutherford	23	22	22	22	24	24	24	†	24	26	27	24	24	‡	‡	960	Good.
Sampson	17	19	15	17	12	20	18	19	11	14	14	10	15	‡	‡	1,200	Very good.
Stanly	.....	.....	.....	.....	.....	.....	.....	.....	.....	8	7	7	.....	.....	.....	1,000	Very good.
Swain	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	The keeping of the poor is let out to the lowest bidder.
Transylvania	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	
Tyrrell	5	3	4	5	3	3	3	3	3	4	4	3	4	.....	.....	11000	Good.
Union	27	23	12	15	15	14	14	14	14	14	15	16	16	.....	3	2,000	Good. [in private quarters.
Vance	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	This county has no poor-house, paupers being provided for
Wake	†	†	†	†	†	†	†	63	55	†	57	.....	.....	.....	.....	‡	Good.
Warren	9	†	12	12	11	12	12	13	†	13	11	.....	12	‡	‡	2,000	Very good.
Watauga	8	8	8	8	8	9	8	9	9	8	8	.....	8	‡	‡	‡	Good.
Wayne	10	7	4	3	3	5	3	3	†	†	5	.....	5	‡	‡	825	Good.
Wilson	†	†	23	†	†	†	†	†	22	‡	22	.....	.....	.....	.....	‡	Good. [poor are all in the care of private individuals."
Yancey	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	This county has no poor-house. The Sup't of Health says: "Our

*The smallest space reported during year is given.
†No report received.
‡Not given in report.

TABLE SHOWING CONDITION OF JAILS FOR YEAR 1886, IN THE COUNTIES

REPORTING TO THE STATE BOARD OF HEALTH.

COUNTIES.	NUMBER OF PRISONERS CONFINED DURING												AVERAGE NO.			Cubic Feet Space Allotted Each.	GENERAL REMARKS ON SANITARY CONDITION, DEC. 31, 1886.
	January.	February.	March.	April.	May.	June.	July.	August.	September.	October.	November.	December.	Confined during the Year.	Vaccinated.	Which can Read and Write.		
Buncombe	27	16	16	15	30	25	14	9	9	11	18	13	17	14	12	542	Excellent.
Burke	a	a	a	a	b	3	4	5	a	a	a	....	4	a	a	b	Good.
Cabarrus	.....	.....	.....	.....	.....	4	4	4	4	2	.....	2	3	.....	a	1,256	Not heated at all, and sewerage exceedingly bad.
Camden	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	No report on jail.
Catawba	.....	4	3	4	1	2	.....	.....	.....	.....	10	8	3	1	2	438	Good. Repairs recently made.
Chatham	3	b	2	2	3	2	3	4	6	2	1	1	3	1	1	2,600	Good.
Cherokee	.....	1	1	2	2	2	3	2	4	1	3	1	2	b	b	1,050	Kept clean and warm.
Cleveland	6	9	a	6	4	5	8	10	15	12	9	10	9	b	4	364	Improvements contemplated.
Columbus	3	4	4	3	5	6	5	3	2	2	2	9	4	b	2	729	Fair.
Cumberland	4	3	3	5	3	6	7	6	6	7	6	.....	5	3	3	800	Excellent.
Davidson	7	12	4	4	7	7	7	7	5	11	13	3	7	.....	2	842	Good.
Duplin	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	1	.....	.....	.....	450	Defective sewerage. Improvement contemplated.
Durham	15	a	8	13	7	6	7	8	18	2	3	4	8	b	b	561	Good.
Edgecombe	21	20	28	28	14	9	11	9	10	14	13	.....	16	b	b	245	Excellent. [Except space.]
Forsyth	a	26	23	23	5	5	5	7	8	4	a	.....	12	11	4	325	Good.
Franklin	4	4	6	4	3	5	5	2	4	7	3	6	4	3	1	700	Very good. [means for heating.
Gaston	9	12	7	5	4	8	10	13	12	7	7	7	9	1	3	585	Situation bad. Construction bad. No ventilation or proper
Greene	7	7	11	2	3	4	4	3	2	3	2	3	4	1	1	1,000	Improvement needed in light and ventilation.
Guilford	a	a	27	17	18	b	a	17	17	a	38	20	22	b	b	200	Good. [Except space.]
Henderson	7	5	6	5	4	5	5	a	5	a	a	.....	5	5	4	3,600	Good.
Iredell	a	13	16	32	21	17	14	b	10	a	a	.....	18	b	b	36	Pretty fair. [Except space.]
Johnston	a	16	6	5	5	9	11	18	7	8	10	13	10	7	3	115	Very good. [Except space.]
Jones	5	5	2	2	3	3	a	3	3	3	2	2	3	b	1	1,260	Excellent.
Lenoir	7	2	1	5	3	b	5	20	3	4	4	6	5	b	2	235	Good. [Except space.
Lincoln	4	4	8	2	4	4	5	5	9	b	5	5	5	b	b	856	Pretty good.
Macon	.....	a	2	.....	5	a	2	2	2	12	5	5	4	1	2	400	Good.
Madison	.....	2	1	2	3	.....	.....	5	13	1	.....	5	3	.....	.....	224	Insufficient in size and supply of water-closets.
McDowell	3	5	4	9	12	7	4	2	3	5	6	6	5	2	3	400	Good.

Montgomery,	.....	.....	.....	.....	.....	.....	.....	.....	.....	2	.....	.....	.....	.....	.....	500	Good.
New Hanover	16	24	26	*	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	
Northampton	a	a	a	a	a	b	a	a	b	b	b	.....	.....	.....	.....	.....	
Onslow	2	3	3	3	4	3	3	5	3	3	3	*	3	.....	.....	1,200	
Person	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	2	.....	.....	.....	.....	1,120	Fair.
Pender¶	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	
Pitt	a	a	a	7	10	7	a	6	a	7	.....	.....	7	.....	.....	.....	.Good.
Polk	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	2	.....	.....	.....	.....	535	Needs improvement.
Richmond	a	a	11	9	11	7	6	5	6	11	11	15	9	3	5	643	Good.
Robeson	23	7	6	8	6	5	6	21	5	10	10	12	10	b	b	300	Imperfectly heated.
Rowan	17	b	13	15	2	5	5	7	7	7	7	6	8	b	b	1,200	Good.
Rutherford	4	1	1	3	3	6	8	a	6	6	5	5	4	b	b	855	Good.
Sampson	7	4	3	4	2	.....	1	4	6	6	2	3	4	b	b	700	Very good.
Stanly	.....	.....	.....	.....	.....	.....	.....	.....	.....	7	3	3	.....	.....	.....	1,000	Very good.
Swain	.....	.....	.....	.....	.....	.....	.....	.....	.....	1	.....	2	.....	.....	.....	559	Very bad, with no efforts at improvement.
Tyrrell	.....	.....	.....	.....	.....	.....	.....	.....	1	.....	.....	1	.....	.....	.....	11,000	New and in good order.
Transylvania	.....	.....	.....	.....	.....	.....	.....	.....	.....	3	3	.. ...	.....	.....	.....	b	Excellent.
Union	5	4	18	5	6	4	5	5	4	5	5	6	6	.....	3	1,000	Bad. New one talked of.
Vance.¶	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	
Wake	a	a	a	a	a	a	a	16	18	a	21	.....	.....	.....	.....	1,200	Arrangements for heating defective.
Warren	11	a	1	4	10	10	5	9	a	7	8	.....	7	b	b	700	Generally good.
Watauga	1	.....	.....	1	1	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	b	Bad.
Wayne	23	2	24	25	15	23	25	28	a	a	24	.....	21	b	b	10	Very bad. Improvements contemplated.
Wilson	a	a	4	a	a	a	a	a	5	13	10	.....	.....	.....	.....	b	Good.
Yancey	.....	.....	.....	.....	.....	.....	.....	.....	1	1	1	2	.....	.....	.....	b	Good. Bedding bad and uncomfortable.

*Jail burnt at this time. ‡This shows smallest space reported during year.
a. No report. ¶Has no jail at this time.
b. Not given.

ANALYSES OF WATER FOR THE NORTH CAROLINA BOARD OF HEALTH,

Made by the Agricultural Experiment Station in Years 1885–'86.

Station Numbers.	MARKS.	WHEN RECEIVED.	NAME AND ADDRESS OF SENDER.	Grains per Gallon.		Parts per Million Ammonia.		REMARKS OF CHEMIST.
				Total Solids.	Chlorine.	Free.	Albuminoid.	
3307	Well of Charles Hines,	1885. May 1st.	Dr. Pritchard, Faison, N. C.	11.50	2.98	.48	.32	A bad water—one that may give trouble. The high quantity of ammonia present indicates some organic contamination, possibly owing to nearness of cess-pool.
3383	Taken in front of Boyden House.	July 14th.	E. B. Neave, Mayor Salisbury, N. C.	19.60	4.16	.16	.20	Chemical analysis does not indicate anything of a serious character. Still it may propagate germs of disease of which we have discovered nothing.
3408	No. 1, J. Private Well.	August 15th.	John C. Jacobs, Supt. Health, Henderson, N. C.	4.70	0.56	.186	.20	Somewhat contaminated with organic matter. Quite enough ammonia, etc., to admit of development of germ life, though I am not sure the contamination is animal.
3409	No. 2, B. B. Warehouse.	" "	" "	4.80	0.49	.08	.16	Slightly suspicious.
3410	No. 3, T. P. Public.	" "	" "	7.20	0.71	.0132	.15	Vegetable contamination. Suspect surface water runs into this one.
3534	Turnpike between Wilmington and Wrightsville Sound, 7 miles from Wilmington.	November 11th.	James C. Stevenson, Wilmington, N. C.	8.50	1.20	.00	.06	Very pure water.
4025	Well of self at Whiteville, N. C.	1886. August 30th.	A. F. Powell, Vineland, N. C.	(a) 4.40	.....	.....	.....	Extremely small amount of dissolved matter of any kind. Very slight hardness. A pure water.

4086	B. Farm near Tarboro, N. C.	Septemb'r 17th.	* Dr. J. M. Baker, Tarboro, N. C.	6.90	.66	0.0266	.05	Fairly pure water. Nothing to indicate any harm in this water.
4087	W. Spring near Tarboro, N. C.	" "	"	7.90	.44	0.066	.03	Free ammonia rather high, but otherwise as good as the average.
4088	P. Spring near Tarboro, N. C.	" "	"	8.90	.55	.48	.05	Odor of sulphuretted hydrogen on opening bottle. Why so much free ammonia in spring water? Can it be contaminated with manure leachings?
4089	Caker. Well in Tarboro, N. C.	" "	"	23.30	6.01	.0534	.04	Slightly suspicious. May be contaminated from animal sources, as there is too much clorine and free ammonia in connection.
4090	Sizer. Well in Tarboro, N. C.	" "	"	39.60	14.13	.0266	.04	Too much clorine—may possibly be of mineral origin, however. Look for source of animal contamination.

(a.) Solids consist of carbonate of lime and iron, and some chloride of sodium.

REPORT OF DR. J. W. JONES, PRESIDENT, ON THE NORTH CAROLINA PENITENTIARY.

CAPT. E. R. STAMPS,

President North Carolina State Penitentiary, Raleigh, N. C.:

By an invitation of the Board of Directors of North Carolina State Penitentiary, the North Carolina Board of Health sent to the Penitentiary a committee consisting of Drs. J. W. Jones and S. H. Lyle; Prof. W. G. Simmons and Arthur Winslow, C. E., to make a sanitary inspection, on May 22, 1885. The committee were impressed by the cordiality of their reception and the willingness of the officers to give them information that might in any way aid them in the discharge of their duties.

It is regretted that this report has been so long delayed. It was not for want of interest in the work.

The committee are conscious that they made a hasty visit to the Penitentiary, but entertain the belief that, by the aid which sanitary science affords them, and the assistance so cheerfully rendered them by the officers in charge, they have not greatly erred.

Many circumstances affect human life. Its fundamental laws connot be violated with impunity. In prison life, the arrangement of the prison, the air, the water, the hours of rest and labor, the quantity and quality of food, the protection from excessive cold and heat, are all big factors in health and disease, over which a watchful care and intelligent oversight must be taken, that knows no abatement. The air, water and food may be made unclean and unhealthy by the environment, the air and water taking up noxious gases and bad emanations that come from decomposition of matter, together with the food in its connection with the air and water when taken into the body to sustain it, become, at the same time, carriers and causes of diseases. Also good food improperly prepared, or not suited to the condition, may become a source of disease. The houses should be so constructed as to protect us against inclement weather and not per-

mit the accumulation of foul air, and to have a sufficiency of pure air and light. The clothing should be of a sort to render us comfortable and to protect us from the excessive cold and heat, clean and dry. The hours of rest and labor should be ordered with a Christian vigilance.

The high death rate as reported by the President of the Board of Directors can only be accounted for by a violation of some one of these laws of health in the Penitentiary, stockades or county jails.

No facts or conditions are given in the report of the President of the Board which will account for the high death rate or enable the committee to advise in the matter from the report.

From the greater amount of sickness at certain stockades, as reported, it would seem that there are local causes operating at these points that produce disease, which the Directory would do well to have studied, in order that the causes may be removed.

We cannot too strongly urge the immediate consideration of Mr. Winslow's report, which please find herein. Foul air and noxious gases will surely cause disease and unfit the convict for the exposure and labors of stockade life.

For the better study of disease causation of the Penitentiary, it is suggested that the physician give in his report not only the number of cases of sickness of all kinds, but in addition the names of the diseases treated in the Penitentiary, stockades and farms.

It is hoped that we may devise means for a better sanitary condition of the county jails, which will relieve the Penitentiary of much of its sickness and mortality.

We are making efforts to have each convict sent to the Penitentiary furnished with a descriptive list by the County Superintendent of Health, showing the time he has been in prison and the state of his health. This is for the guidance of the Superintendent and Physician in the treatment and selection of labor suited to each convict. Respectfully submitted,

J. W. JONES, M. D.,
President N. C. State Board Health.

TARBORO, N. C., July, 1885.

REPORT OF PROF. W. G. SIMMONS ON THE NORTH CAROLINA PENITENTIARY.

To Dr. J. W. Jones,

President Board of Health of North Carolina:

The North Carolina State Board of Health accepted an invitation to visit the Penitentiary, and a committee, consisting of four members of the Board, made an official visit to that institution May 22d. The authorities extended every facility for examining into its condition and management.

The committee of the Board found that the convicts are supplied with an abundance of wholesome food, that the water is good and the water supply is fully adequate to every sanitary requirement.

The buildings are in good condition and all necessary attention is given to cleanliness in all the apartments, including the hospitals and cells for the convicts.

The cells are not as large as they should be; their capacity is only * cubic feet. This necessitates that extraordinary care should be given to the matter of ventilation, especially during the night, when they are occupied.

The attention of the authorities was called to this point, and they expressed an earnest wish to do all that could be done to obviate the difficulty.

The sewerage is defective and the traps are not all in safe condition.

As the water supply is ample, it will be an easy matter to correct this evil. The Civil Engineer of the Board will give his special attention to this matter at once, and as the authorities are in full sympathy with the Board, there can be no doubt that his suggestions will be readily complied with and that the danger from this source will be speedily removed.

Respectfully submitted,

W. G. SIMMONS.

*Number of feet to be ascertained by the Civil Engineer and reported by him.

REPORT OF DR. SAMUEL H. LYLE ON THE NORTH CAROLINA PENITENTIARY.

To Dr. J. W. Jones,

President Board of Health of North Carolina:

Taken as a whole, the Penitentiary is in the most perfect sanitary condition of any building I have ever seen; still, there are some points to which it might be worth while to call the attention of the Board of Directors.

The cells contain only 265 cubic feet air space when empty, which is not enough unless changed very frequently, especially in the lower cells, where the air from the upper rows of cells settles by virtue of its weight. There should be some arrangement by which a strong current of air could be made to pass through the ventilating flues all night. This could be best accomplished by a steam or some other blower, arranged on the same principle, or if this is not used, a jet of steam allowed to escape into the flue, so as to produce a partial vacuum, would accomplish the purpose, but not so well. As the system of ventilation is arranged now, the lower row of cells is not safe.

The privies are all in good condition and the water-closets well nigh perfect, but in the bath-room in the basement, as at other points designated by Mr. Winslow, in his report, there are no traps in the sewer and water pipes, or if so, they are so far from the opening of entrance that they do not answer their purpose, allowing the escape of sewer gas into the bath-room and from thence into the other basement rooms. I recommend that the traps be placed immediately at the internal end of these pipes.

I have a great many other notes, but as Mr. Winslow and myself took the same, from this time on they will appear in his report.

Very truly, yours,

SAMUEL H. LYLE, M. D.

REPORT OF ARTHUR WINSLOW, C. E., ON THE NORTH CAROLINA PENITENTIARY.

RALEIGH, N. C., June 13, 1885.

DR. J. W. JONES, M. D.,

President N. C. State Board of Health, Tarboro, N. C.:

DEAR SIR: I herewith respectfully submit to you my report on the sanitary condition of the State Penitentiary, with particular reference to the plumbing, disposal of sewerage and ventilation of the buildings.

The report is necessarily general and incomplete, from the fact that I had not the time nor the power to make a detailed and thorough examination, and also because much which should have had personal inspection is hidden behind walls, beneath floorings, or is deep under the ground, and therefore many facts had to be taken for granted or obtained by inquiry from the officers of the institution.

The *plumbing* of the building, as far as I could observe, seemed excellent and in good order.

According to Col. Hicks's statement, the waste pipes from kitchen sinks, bath tubs, etc., are trapped effectively before entering the drain or soil pipes, thereby preventing poisonous sewer gases from escaping into the different apartments. The form of *water-closet* used is of a self-acting pattern, in which the basin is flushed through the action of a spring seat upon a valve in the supply pipe. The soil pipe is said to be properly trapped beneath the basin, and the basin to be provided with a ventilating pipe which leads to the top of the building; both necessary precautions. The method of flushing the basin, however, is to be objected to, if not condemned. Direct supply of water to *water-closets* from cisterns or mains from which drinking water is drawn, is universally condemned. The supply should always be from a separate flushing cistern. The rough diagram on next page represents the principle of the water-closet system in use at the Penitentiary.

The vertical water pipe connects directly with the large water tank on the top of the building and from this same pipe water for drinking, washing, bathing and water-closet purposes, is drawn directly and at different levels. Now, while there is pressure in this pipe sufficient to cause a strong outward flow through the water-closet supply pipe, when the valve is open, there would seem to be little danger to apprehend from this direct connection; but, should the efflux of water from the various openings below this level be sufficient to cause the maximum possible flow of water through this pipe at the existing pressure, or should the tank become empty at any time, then, when the water-closet valve is opened, there would be a suction through the supply pipe into the water pipe carrying back the stagnant and contaminated water and the poisonous gases. This is especially liable to occur in the upper stories where the outward pressure of the water is least and below which there is most liability of an exhausting demand upon the water supply pipe. And it is just at the upper levels, evidently, that contamination of the water would be most dangerous and far reaching in its effects. Though, ordinarily, the danger from this defect may not be very great, a small amount of such contaminated water would be very dangerous in cholera times, or with the prevalence of typhoid fever.

The location of the water-closets, especially in the hospital departments, is also to be objected to as too close to the bedrooms, and as with too direct a connection, only one door intervening, and this probably frequently left open. In the basement floor, between each two blocks of cells, and connected with them by four (4) doors, are the prison bath-rooms. These are furnished with iron tubs supplied with hot and cold water. The escape pipes are said to be all suitably trapped. In the centre of the floor is the opening of a large pipe which leads directly into the sewer pipe at a distance of two (2) or three (3) feet below the floor. This untrapped direct connection between the sewer and the cell compartments might seem a dangerous source of disease, and this it would be were it not that there is a strong

downward draught through this pipe, which effectually prevents any sewer gases from flowing into the bath-room. This downward draught is produced by the action of a ventilating pipe, which runs from the main sewer up through the kitchen chimney flue to the top of the building. The heating of the air in this pipe causes a stroug upward current of air, which produces an inward flow of air from all parts of the sewer. This is, however, entirely dependent upon the heating of the pipe, and should it at any time be allowed to become cold, especially in summer, a reverse flow of air would set in and the poisonous sewer gases would be poured out into the cell chamber through these openings in the bath-room floors. The sewerage flows out into the opening, just outside of the west portion of the wall surrounding the buildings, whence the water flows down through channels in the earth and over broken stone to an adjoining branch. The solid matter is largely precipitated here and arrested by the broken stone and forms a constantly increasing accumulation of filth. This, at present, is not noticed to produce any disagreeable effects, but with the completion of the buildings more closely adjoining this portion of the wall, and with the increase of this deposit, I cannot but think that it will prove a source of discomfort, if not of danger. I should advise the pipes being prolonged as far as the branch at least.

The *ventilation* of the rooms and cells in the buildings is by no means perfect. In the wash-room and shoe-shop no adequate provision is made for a sure supply of fresh air. The windows are opened and closed according to desire, and during the winter it is more than probable that they are almost entirely closed for the greater part of the time. Each cell is ventilated by means of two separate flues, which lead to the top of the building. As there are five (5) tiers of cells in each block, ten (10) flues open out over each column of cells near the roof. Eight (8) of these sets of ten (10) flues each are there run together and connected with a central flue, containing a steam coil, which, when heated, is intended to create an upward draught in these flues. The working of this system of ventilation seems, however, very de-

fective. The steam coils are not kept heated all of the time, and thus in summer, when the walls of the building are cooler than the outside air, a downward current must set in, and even when heated the coils are so near the top of the flues that the short column of heated air is, under the most favorable circumstances, not able to produce a strong upward draught. As roughly tested by me a few days ago, a downward current was found to exist in these flues, while the coils were cold, and, after steam was introduced, a very slight change for the better was noticed, the air appearing to be nearly stagnant and fluctuating irregularly from a slight upward to a slight downward flow, according as any current of air happened to influence it. This is certainly to be strongly objected to, and though in summer, when doors and windows are open, sufficient fresh air may reach the prisoners without the aid of the ventilating flues, this backward draught makes the conditions worse than with no flues at all, for the gases and vapors from the night buckets are blown directly back into the cells, often around the prisoner's head, whose bunk is immediately over the opening. In winter, when fresh air has not such free access, these flues should do good work, in order to keep this compartment, containing as many as 160 sleeping men, in a healthy condition. The capacity of each cell is about 300 cubic feet. To maintain the air in a healthful condition with such a space, when occupied by one man, it should be completely changed ten (10) times in each hour. The ventilating flues are 9x5 inches in section. If the escape of the ventilated air is to take place entirely through these flues and equally through each, it should flow with an average velocity of at least 80 feet per minute. If the ventilators cannot be made to produce this rate of flow they should at least be perfected to the extent of never allowing a down draught to sweep back into the compartments the very gases which the flues are designed to carry off.

The *water supply* is chiefly derived from a reservoir occupying the site of the old granite quarry. It is fed by a large spring in the bottom. The water is clear and free from sediment, and

the reservoir is open to the light and air, and is not rendered impure by any vegetable growth. The water is pumped from the reservoir to a tank on the top of the building, whence it is distributed through iron pipes.

Some of the drinking water is also taken from a well on the west side of the buildings, but both of these sources of water supply are remote from any possible sources of pollution. The heating of the buildings is effected by the steam pipes and hot air. It seems in all respects satisfactory. The air is taken directly from the outside, remote from any sewer opening, and is heated by steam coils. In concluding this report, I must apologize for my delay in preparing it. I have, however, been very much pressed with other work which demanded my prior attention, and I have devoted the very first available opportunity to this work. I am well aware of its deficiencies, but trust that you may be able to extract some information of value.

I am, sir, very respectfully, yours,

ARTHUR WINSLOW, C. E.

REPORT OF DRS. THOMAS F. WOOD AND W. D. HILLIARD ON THE CONVICT STOCKADES.

WILMINGTON, N. C., June 1, 1885.

The Board of Directors North Carolina Penitentiary:

GENTLEMEN:—In accordance with your invitation to make a sanitary survey of the prison camps under the charge of the State Penitentiary, the North Carolina Board of Health appointed Dr. W. D. Hilliard, of Asheville, and Dr. Thomas F. Wood, of Wilmington, to make the tour of inspection. Accompanied by Capt. A. D. Brown, of Wilmington, member of the Penitentiary Board, we visited the Balsam Station, in Jackson county, the Tennessee Station, the Nantahala Station, the Asheville Junction Station, and the Arden Station, in Henderson county.

As a result of this tour of inspection we beg leave to lay before you such suggestions as in our opinion would promote the health and working abilities of the convicts held by the State, and also to further their well-being. These two objects we have kept constantly in view. We will remark on the several stations in detail, and finally make such general observations as may apply to the entire convict system as seen by us in the western counties.

The Balsam Station is well located, and the quarters furnished for the twenty-eight men there we found to be in good condition, and the employment of the men—saw-mill work—of a kind to promote their health.

We found two men suffering slightly here from diarrhœa, but we had no opportunity of examining those at work. Upon the whole everything here was satisfactory.

The second station we visited was the one on the Tennessee River — miles from Charleston, in Swain county. Here we found accomodations for forty-seven men, in quarters located directly on the sloping shore of the Tennessee River. The camp is well located for drainage and water supply.

The food prepared for the convicts was examined and found to be of good quality. The corn-bread was specially well baked, and made of sweet meal, quite well bolted. This we believed to be much better than corn-bread usually consumed by the men who compose the large majority of the convicts. Flour bread was not a part of their diet, and would indeed not be a desirable article of food unless better prepared than is usual in camp.

The water supply is from a flume from the mountain, the water being conducted through the inside of the prison, the water going in sufficient volume and force when at its maximum to keep the fœcal deposits from the men well washed away. Drinking water is within easy reach through a hand-hole near the chimney, enabling a prisoner at will to get pure water. The ventilation in the prison is chiefly accomplished through the loosely laid clap-boards of the roof and through the large fire-places. The disadvantage of this, though, is that during rain

storms the roof leaks quite freely. This is a general condition of all the prisons, and will be mentioned more in detail hereafter. The free use of whitewash in the quarters and prisons added to the general tidiness and sweetened the atmosphere of the prison. We did not have the opportunity of inspecting the prisoners in their quarters, as our visit was near midday, while they were absent at work.

The examples of untidiness which we discovered at the Tennessee Station were the dirty condition of the blankets exposed for airing, and the necessity arising, by reason of the night guards not being allowed to leave their posts, of making use of the ground in the rear of the prison to *relieve* themselves. We found here four convalescent patients, and no hospital supplies, not even to the simplest remedies in case of sudden emergencies. Upon the whole, this station was in a fair sanitary condition.

On Tuesday we proceeded to the Nantahala Station, — miles from Charleston. This camp is located on the Nantahala River, shut in by the mountains on both sides. It is a clearing of small area, and not nearly so favorable for a camp as the Tennessee Station, mentioned above.

We reached this station during a rain storm, and had the first opportunity of seeing the prisoners confined in their quarters. Neither the drainage, water-supply nor ventilation were very good.

This was owing to the natural disadvantage of the location. The prison is a large log house, loosely covered with clap-boards, admitting fresh air, or, rather, letting out foul air, but insufficient protection in the time of rain.

The bunks of the men are built in two tiers, about four feet from the ground for the first, and the second tier about three feet above the first. The bed sacks are filled with straw of varying degrees of cleanliness. The blankets were of good quality but not as clean as they should be. During the day of our inspection, the dampness of the men's clothing and blankets imparted a peculiar choky odor to the prison, the doors at the time being wide open. The cubic space of air allowed to each prisoner was about 230 feet.

The hospital building is also a log house, kept quite clean, and used also as a drug department. The number of patients confined there was 10. Of this number we will mention a few in detail:

Robert Williams, a colored man from Halifax county (No. 5766), is a dangerous lunatic, subject to violent fits of rage, imperiling the other convicts in hospital. We would suggest his early removal to the Goldsboro Asylum, or some other place of safety, as the means at the command of Dr. Schenck, the surgeon in charge of the station, are entirely inadequate. The calamity of a fire or homicide by the hands of this insane criminal is too horrible to contemplate, but are not at all improbable consequences of his detention there.

Jackson (5709) has several old fractures and one umbilical hernia, the sum total of his disabilities making him unfit for duty there.

Cradle (5716) needs a truss, but even when properly fitted (a matter not easy to do at this remote station) would not be of much use as a laborer.

John Summerville, a patient with an imperfectly united fracture, is a particularly unfortunate case.

His fracture, according to his statement, was discovered by Dr. Moore, the medical officer who preceded Dr. Schenck, but it was not treated skilfully, and a permanent lameness will probably result. Dr. Schenck has instituted treatment which promises success after a long time, but the service of the prisoner as a laborer is lost for an indefinite period.

The roofs of the hospital and prison were not tight enough, as mentioned above, but of the former building, orders were issued the day of our visit that it should be repaired.

Asheville Junction Station was visited on Thursday, the 28th of May. The prisoners are kept in a former brick warehouse, belonging to the railroad. The location is flat and difficult to drain. The roof is more secure against rain than in the other buildings, and has a false roof to permit better ventilation. Water is not easily obtained here, and the privy arrangements

are not good. The floors were not clean, owing to the former storage and leakage of salt when the building was used as a warehouse, and because of the numerous rainy days. The bunks of the men are built as described at the Nantahala Station, and the bedding in fair condition, except as to the blankets, and there had been so much rain there was little opportunity to sun them.

The hospital arrangements here are defective, and especially there is a need of a proper privy. The very offensive bucket system, we were told by the medical officer in charge, Dr. Burgin, was the best they could do. The privy of the main prison, while separated by a door which can be closed, must of necessity allow foul odors to come into the prison and vitiate the atmosphere. The difficult question, how to construct a proper one, which would be entirely secure to prevent escape of prisoners and not foul the atmosphere of the prison, has not yet been solved. The water supply is very objectionable, and consisted of open buckets set about in prison. The impure air of a room where eighty-four men are confined, with not more than 350 cubic feet of air, doubtless vitiates the water, and by morning it must be unfit for drinking, and would likely, in some epidemic conditions of the atmosphere, cause serious sickness. This could be remedied, in absence of a good supply of brook water, such as they have at the Tennessee Station, by placing a couple of barrels of fresh water outside the walls and delivered on the inside by means of a spicket. The preparation of food here is of rather a better quality, owing to the skill of the cook.

On Friday, May 29th, we visited Arden Station, in Buncombe county. The prison here is a log house with clap-board roof. The floor in the prison was only partially laid, and the part uncovered by flooring, was damp, making it necessary to lime it pretty freely. The privy arrangements here are scrupulously well cared for, and hardly the slightest odor of urine could be detected. Owing to the prevalence of wet weather the blankets were not well sunned, as a matter of course.

The shed under which the prisoners ate was very tidy, and the tables clean and tidy, and the tin-cups bright and clean.

In the hospital, there were ten men sick, out of a total force of ninety-five, but this included injured men. The hospital quarters were cleanly, but must be choky and foul when the doors are shut and the "bucket" used by the sick. This, the surgeon in charge pointed out as a serious annoyance, and it was very evident.

The cooking apartments at Arden were clean and tidy, and all seemed to be under good management. The preparation of food was good, and of the same quality as we had seen at all the stations. We did not get an opportunity of examining the men in their quarters at Arden or at the Asheville Junction Station, much to our regret, as no adequate conception could be formed of the suitableness of quarters until occupied. We had therefore to take our observations at the Nantahala Station to serve us in estimating the fitness of the others.

We would not do justice to the Captains of Quarters, in charge of the quarters, if we did not mention their evident fitness for their positions, without an exception. Each one seemed to be correctly impressed with the necessities and wants of the convicts, to preserve them in the best health and working condition. Sobriety and industry we observed as marked characteristics, and firmness and moderation tempered with mercy, seemed to be the rule.

In this short sketch we fear we have not specifically detailed all that would be necessary for a correct comprehension of the condition of the State's convict camps, but without tiring you with further details we will set forth as briefly as possible such suggestions as we believe would maintain the convict force in the best state of health, to enable them to effectually work out their sentence at "hard labor," and at the same time to temper it all with mercy.

It is the State's interest as well as the prisoners' that the period of penal servitude should be attended with all reasonable means to insure the prisoners' health. Fresh air, good water, well prepared food in sufficient quantities, dry and comfortable lodging places, an amount of work proportioned to the strength of each convict, enable the prisoner to serve his time to the best advantage.

Prisoners are more difficult to maintain in a robust condition than any other like number of men living in crowded communities. So far from being well off with less than is needed for the same number of soldiers, for instance, they really need more. In the long run it is expensive to neglect or slight the prime necessities of life of the convict. A sick prisoner is an expensive prisoner. The suggestions which we have the honor to make are designed to promote the working qualities of the prisoners in the highest state of efficiency.

VENTILATION.

The ventilation of these log prisons could be improved and made tighter by having a false roof made. This would not lessen the security of the prisoners. Any ordinary mechanic could construct such a roof so as to prevent the slanting rain from driving in. This plan was adopted at the Asheville Junction Station.

PRIVIES.

It is a prime necessity that the privies should be kept scrupulously clean. A good stream of water is best when available. When it cannot be had the dejections should be received in barrels or boxes having a layer of copperas in them, the whole to be covered during the night with unslaked lime, and the barrels and boxes emptied as soon as the prison is cleared in the morning. The barrels should be taken to a sufficient distance from the quarters, and remotely from the source of water supply and the contents buried, and then the barrels thoroughly limed, and allowed to air to be used again at night, each prison having two sets of barrels.

THE URINE

Is a very serious source of annoyance in most prisons, and its management is of prime importance. A good arrangement is the one we noticed at Arden, designed by Mr. McMurray. This receptacle carries off the urine and catches the last drippings,

the accumulation of which, from numerous prisoners, although small in quantity, can fill the air with stench in one night. If buckets must be used in the hospitals, they should be provided with covers, and a sufficient quantity of a saturated solution of copperas be placed in each bucket at night. But the bucket plan is worse for a hospital than for the prison where the well are confined.

THE BUNKS.

The arrangement of the bunks in all the prison quarters was objectionable. That is to say, they are in two tiers, and the ventilation of the lower bunks always faulty. Furthermore, the men coming in from work, with muddy feet, carry enough dirt into their bedding to sift through on the men below them. We would suggest that the bunks might be arranged differently, with little increased expense, so that they may have better ventilation, and the prisoners kept well in view of the guard. One plan would be to construct the bunks tier above and behind tier, as the seats in an amphitheatre. This would give space beneath to enable the men to keep the prison clean and really give more room to all. This arrangement would necessitate passage-ways through and around the bunks for easy access, and keep men from stepping in each others' beds. The accompanying sketch may better explain the design.

STOCKADE.

A stockade around the prison would add greatly to the health of the men. On Sunday and on rainy days, when the men are not at work, they are confined to the prison, and with a stockade they could be allowed an airing and more liberty, and be as completely under the eyes of the guard.

WET CLOTHING.

During the rainy season it is difficult to keep the men dry, and wet clothing is a source of sickness as well as a means of befouling the atmosphere of the prison. We would suggest that

each gang of 12 to 15 men be provided with a fly tent, which could be taken to work every day, and in case of sudden rain, tent poles could be readily improvised, and tents pitched to protect the men and guards from the rain. It is the experience of the Captains of Quarters that sleeping in wet clothing is the source of much sickness.

HOURS OF DAILY LABOR.

Upon inquiry we found that the men were actually worked from 14 to 15 hours a day. That is to say, that from the time they left their quarters in the morning until they returned at night, that much time was consumed. Part of this, of course, was consumed in walking to and from the work. We suggest that this time should be reduced, so that the men get two hours at dinner and are not worked more than ten hours a day, and that on Saturday they be returned to quarters by 4 o'clock in the afternoon, to prepare for washing and bathing. As it is, the bathing of the prisoners is done on Sunday, and the prison officials are as busy on this day as any other. There is an undeniable physiological necessity for one day of rest, and it is applicable alike to prisoners and their custodians.

These observations on the length of day's work are founded partly upon personal examination of the general physical appearance of the prisoners, and partly upon our inquiries from the medical officers and other officials. The men had the appearance of anæmia—*i. e.* poor blood—although there were but few cases of a slight degree of scurvy. As the variety or quality of the food was not at fault, our inference was that the prisoners were taxed beyond their power of efficient work and reasonable endurance. We are well aware that prisoners are prone to impoverished blood, by reason of crowding together, and the utmost care should be taken that overwork should not be added to this other almost inevitable source of physical impoverishment.

THE FOOD.

The food is, in variety, sufficient. Mr. Troy supplies the men with potatoes, kraut, onions and cow-peas, as well as the sub-

stantials of corn bread and meat, to which he has wisely made preparation to add flour bread. If this is properly prepared, it will be a very grateful and sustaining article of diet. Badly prepared flour bread, such as one finds almost universally in the remote mountain country, would be a detriment. And this leads us to say, that more attention should be paid to the preparation of food. It would be economy to employ an expert cook, or take an expert cook and send him from station to station to instruct others in cooking. This is more especially a necessity as far as bread-making is concerned.

We highly commend the wisdom of giving the men cow-peas as an anti-scorbutic, and these alternated with potatoes and onions, kraut and pickle occasionally, will serve to prevent scurvy. The absence of this disease we attribute to such supplies now furnished the men.

We could not make this tour of inspection without noting how much depends upon the selection of competent medical men. These gentlemen are not only physicians, surgeons and hygienists to the prisoners, but they daily sit in judgment upon the difficult questions of right and wrong between the prisoners and their legally appointed custodians. These positions, therefore, require the very best men, at the highest price the State is able to pay, and it would be a serious mistake not to recognize this fact. We would like to cite an example, and this unfortunately not hypothetical:

A man complains of being sick and unable to work. He is taken to the doctor, who examines him, and not detecting an obscure heart disease, he pronounces him fit for work. The man is sent to work, but refuses on the ground of disability. He is reported as insubordinate, and is whipped and returned to work. For four successive times this refusal and punishment are repeated, when finally a closer examination by another and better skilled ear reveals the fact that the man has been unjustly whipped, because that he has a valvular inflammation of the heart, which prevents him violent physical exertion. As soon as it is discovered, the man is put in hospital for treatment. This illustra-

tion is not drawn to reflect on any one, but to make more apparent, if need be, the necessity of getting the best skill, at the highest price the State is able to pay.

In this tour of inspection we set out with the principle that it is not only humane and just to the State that her prisoners should be maintained in the highest condition of physical ability, and of course, conversely, that it is uneconomical to neglect any means calculated to promote their physical and moral welfare, therefore we take the liberty of presenting some of the matters which have occurred, and which, we believe, if followed out, will be of service to the management of the Penitentiary.

We here beg leave to acknowledge the courteous assistance rendered us by Mr. W. C. Troy and the gentlemen under him, and to commend their zeal in the work which the State has entrusted to them.

Very respectfully yours,

THOMAS F. WOOD, M. D.
ALEX. D. BROWN,
W. D. HILLIARD, M. D.

REPORT OF ARTHUR WINSLOW, C. E., ON THE NORTH CAROLINA INSTITUTION FOR THE DEAF AND DUMB AND THE BLIND.

REPORT ON THE SANITARY CONDITION OF THE STATE ASYLUMS FOR THE DEAF AND DUMB AND THE BLIND.

DR. J. W. JONES, M. D.,

President of the State Board of Health, Tarboro, N. C.:

DEAR SIR: I herewith respectfully submit to you my report upon the sanitary condition of the State Institutions for the Deaf and Dumb and the Blind, in Raleigh.

In the arrangement of discussion of the various subjects which make up this report, I will not attempt any rigid classification, but will first simply call attention to what I think is to be ob-

jected to, and to what I think can be improved in the sanitary arrangement of the different apartments which were visited during our tour of inspection, and will then offer my suggestions as to what methods and means had best be adopted in carrying out the proposed improvements.

The departments first visited were the school-rooms in the north wing of the building. I was particularly struck here with the insufficient means for ventilation which is provided in these rooms, when their size and the number of pupils occupying them at a time is considered. The rooms are about 21 feet long, 18 feet broad and 12 feet high. The number of pupils in each room varies from 10 to 20. As every room is provided with two large windows, there is probably little difficulty in keeping the air in a healthy condition during the warm spring and autumn months, when the windows can be kept open. But, during the cold months of the year, when, to prevent cold draughts of air, the windows must be kept almost entirely closed for the greater portion of the time, the supply of fresh air must be insufficient, in as much as 15 thousand to 30 thousand cubic feet of fresh air should be supplied every hour. But even with a thoroughly efficient system of ventilation, 18 or 20 is too large a number of persons to occupy such a room at a time. These rooms have each a capacity of about 4,500 cubic feet, and, as to insure good ventilation without harmful draughts, there should be *at least* 300 cubic feet of space per head, it follows, that even with the ventilation of the room perfected, not more than 15 persons should occupy it together for any length of time.

The school-rooms were formerly heated by open fire-places, but these are at present in disuse, and I noticed them in many cases to be closed. This, as far as ventilation is concerned, is to be regretted, as an open fire-place is one of the best of ventilators.

The school-rooms are in pairs running nearly the entire length of the building. In the partition between each two rooms two transoms are cut at about 7 feet from the floor. These transoms doubtless serve a useful purpose when it is desirable to establish

a cool current of air through the rooms from one side of the building to the other, and when there is a great superabundance of air supplied to satisfy all needs. But in winter, when the supply of fresh air is scant and the air currents are slow, they may produce decidedly injurious effects, as, with certain conditions of the atmosphere, the supply of air to occupants of one room would be almost entirely the vitiated air from the other.

The large bed-room in the deaf and dumb department was next visited. This room is 45 feet long, 36 feet wide and 12 feet high, giving a total capacity of 19,440 cubic feet. It is open to the light and air on three sides and is provided with 10 windows and two open fire-places. Thirty-two girls sleep in this room, so that there is about 600 cubic feet of space to each occupant. No special provision is made for ventilation, but reliance is placed almost entirely upon the windows and fire-places to effect this. The former are so numerous that in most weather all the air necessary is probably admitted through and around them. But too much confidence should not be placed in this supposition. 47,000 cubic feet of fresh air should be supplied here during each hour. With no wind stirring outside there must be a very small influx of air into the room when the windows are closed, unless an indraught is produced by fires in the open fire-places.

Closely adjoining this large room is a small bed-chamber whose only connection with the outside air is through the portico in the rear of the building, which is now boarded in and is used as a wash-room and as a room for soiled clothing. The air supplied to this room must therefore be very impure, and it should not be used as a sleeping-room.

In the rear of the large bedroom, on the same floor, is the water-closet. It is separated from the bedroom by a large vacant room, which is used as a trunk and storeroom. The form of water-closet is the trough closet, consisting of a range of seats over a cast iron trough about 8 feet long. The trough is filled with water automatically to a depth of 3 or 4 inches by a regulator ball valve, and is discharged by an attendant at intervals during the day. The cistern supplying the water is used solely

for this and for washing purposes, so that there is not much danger of harmful results arising from imperfect valves or from other causes which might produce contamination of the water in the supply pipe. The waste pipe is also properly trapped before entering the soil pipes. The latter, however, does not extend above the trough of the water-closet and open out at the roof of the building, so as to effect good ventilation, and this is a very serious omission. The form of closet is also bad. In all probability the foul matter often collects and stands for hours in the trough before it is discharged. In the course of use the trough becomes bespattered and coated with filth, and unless constantly flushed and scoured must generate continually noxious gases. This was very noticeably the case in one of the closets visited, where, upon lifting the seat after the escape of the water, the stench was unbearable. In the basement there are other water-closets and urinals of the same design, and open to the same objections.

In the Blind Department, which was next visited, the room used as a hospital was particularly noticed as being too small for its purposes (21 ft. by 16 ft.), and, like all the other rooms, provided with no adequate means for ventilation. It is separated from a large dormitory by only a single door, so that any contagious disease could easily be transmitted to the outside.

Closely adjoining the dormitories of this department are the wash and bath-rooms. The waste pipes from the tubs are not trapped, and lead directly into a "gully" at the foot of the building, or open out into the gutter on the roof of the portico, whence the water is conveyed by an untrapped pipe directly into the gully, and this pipe opens out at the roof of the portico directly opposite a window through which air reaches the dormitory. As the gully is provided with no special ventilating pipe, it is clearly evident that these waste pipes must act as ventilating pipes, and there is nothing to prevent the air from the gully rising directly through them up into the wash-rooms, or up the portico pipe, to be wafted into the windows. Only wash water and rain water flow into this gully, it is true, but the gully communicates

through a large pipe directly with main sewer, and it is doubtful whether this is a trapped connection, though, as no objectionable odor was noticed in the gully, it probably is trapped. But beyond this trap, if it exists, I could find no ventilating pipe to the sewer to keep the air pure and to relieve the pressure in the trap. And as, in this case, the trap is liable to become unsealed, and as the gases which would then escape into the gully and rise into the chambers, or which, in any case, would diffuse themselves through the water of the trap, must be exceedingly foul, these connections between the gully and the interior of the building cannot but be regarded as probable sources of danger.

The boys' dormitory over the chapel is a large room 30 by 45 feet, and 12 feet high, and is provided with eleven windows and one door. It is occupied by thirty boys. In warm weather the supply of air is doubtless more than sufficient to satisfy the needs. But in winter all of the windows are kept closed, and as no ventilating flues are provided, the air must become exceedingly foul.

The large room over the kitchen, which is used as a dormitory for twenty-two boys, is open to the same objection, and its proximity to the kitchen must make it an unpleasant sleeping-room, even in warm months.

The drinking water for the Institution is supplied from a large well in the rear of building. It has all the appearance of an excellent water and is remote from any source of contamination.

RECOMMENDATIONS.

The proper method of ventilating any apartment or series of apartments is by no means a question which can be decided by a rule of the thumb. It is dependent upon the size of the room, the number of occupants, its connection with the outside air, its shape, mode of heating and lighting adopted, &c. The rooms which I consider as most in need of improved ventilation are the school-rooms. As already stated, during the warm months of the year there will be no difficulty in keeping the air of this, as well as of other rooms in the building, in a pure condition. In

winter, however, when a large amount of cold, chilling air must be admitted into a crowded room, the question presents many difficulties for solution. My suggestions are, therefore, intended to apply for the cold winter months, when it is impossible to keep the windows open, and when the cold outside air is heavier than warmed air of the apartment. The new heating apparatus which is being put into the school-rooms is an ordinary steam radiator. When this is heated the warmest air of the room will be immediately adjacent to it, and there will be a column of heated air constantly arising from it. The *desideratum* is that the cold fresh air should enter the room in sufficient quantity without producing disagreeable draughts, should be heated, diffused through the room and allowed to escape.

I should advise, as the simplest effective method of attaining this result, that thin strips of wood be screwed or hinged on to the lower sash of each window, so as to project some three inches below it, and so as to fit closely to the sill and window frame. This will insure a constant opening for the admission of fresh air between the two sashes of each window, and the projection of the lower sash above the upper will cause the air to spout into the room in an upward direction, and it will become diffused and the chill somewhat removed before it settles down to the bottom of the room. Then, under the influence of the ascending column of air from the radiator, it will flow toward the latter, become heated in its turn, rise into the room, become diffused, and rise to the top of the room. To provide for the exit of the vitiated air, an open fire-place with a fire in it is one of the best contrivances. If these are closed in the school-rooms an opening should be made near the ceiling of the room about 8 inches square and leading into a separate ventilating flue, or into the chimney flue if no fire is built in it below the level of the ventilator. It is advisable that the point of exit for the air should be on the opposite side of the room from the point of entrance and from the radiator. The transoms between the rooms, I should advise, in any case, to be kept closed in the winter months when both rooms are occupied.

The sleeping apartments have already been mentioned as not being provided with any adequate means for securing good ventilation. Though the need of improvement did not seem so great in the case of these rooms, it would be wise to ensure a plentiful supply of good air, by making some such improvement as is above outlined for the school-rooms.

The water-closets in this building are, however, the most objectionable features. Their defects have been pointed out. The long trough-shaped receptacle should be removed and some modern form of hopper-shaped closet substituted. This closet should be well trapped in its connection with the soil pipe. It should be flushed from a separate tank used for this purpose only. There are many forms and patterns of good closets. The J. L. Mott Iron Works, of New York, manufacture a good form, and the "Sanitas" patent, of the Sanitas Manufacturing Company, of Boston, is inferior to none. The soil pipe of these closets should be extended above the roof of the building and should be open at the top to ensure good ventilation. All connections between the house and the sewer and gully should be carefully trapped, and the sewer pipe itself should be well ventilated through numerous openings and man-holes. The old idea that a sewer should be kept hermetically sealed to prevent the escape of foul gases is now exploded, and all engineers agree in recommending free connection between the sewer and the open air, so as to keep the air of the sewer as pure as possible. The sewer must, of course, be well constructed, with no bends and depressions to allow of the accumulation of filth, and it should be flushed with rain water as often as possible.

THE COLORED DEPARTMENT.

The colored department of the Asylum was next visited. The school-rooms are generally small, badly lighted, and with no special provision for ventilation. The bed-rooms are mostly of one size, 30 by 18 feet, and 12 feet high, and occupied by 10 individuals. There is one large dormitory, 20 by 70 feet, lighted by 11 windows, and accommodating 20 boys. They are all well

lighted and must be plentifully supplied with air during the warm months of the year. But during the winter the windows are all kept closed while the rooms are occupied, as they are not heated in any way, and the air then must stagnate and become intolerably close. Some method of keeping the air of these rooms pure should be adopted, and to render this feasible, some system of heating the rooms should be introduced which will make the temperature of the air bearable.

The disposal of the garbage and sewerage of this department is, however, what most needs attention. At the time of the visit it was noticed that kitchen slops were thrown out over the ground, within 10 or 20 feet of the well from which the drinking water of this department is taken. This, if a constant practice, cannot but pollute the well-water and give rise to offensive odors.

The greater portion of the slops and kitchen scraps are, however, carried to the lower portion of the yard, near the wood-house, about 50 feet from the main building, and are there dumped into a shallow trench. This spot was visited and this condition of things was found. The slops are thrown upon the ground inside of the fence and the fluids flow along a shallow gutter in the earth, under the fence, out into the street gutter on the outside. They are there supposed to flow off, but, in fact, owing to the defective drainage of the street gutter, they collect and form a long stagnant pool, which extends to within a few feet of a pump and well, the water of which is used by the residents of the neighborhood. And further, as if fully to insure the pollution of this source of water supply, a pig sty is located in the angle of the fence at the east end of the wood-house, and not more than 15 feet from the well. That this state of affairs is to be strongly condemned, goes without saying. Only the grossest oversight and neglect of sanitary precautions would allow it to remain, both for reason of the effect upon the residents of the vicinity through use of the water from the well and for reason of the foul gases that must arise from this ever stagnant pool of putrid water. The slop water from the kitchen should be run directly into the drain-pipe which leads from the building,

through a suitable flush-pot and trap, while the solid scraps of house garbage should be carried away or burnt daily.

The privy arrangements of this department of the Asylum are also exceedingly bad. The privy is a separate out-house, some twenty feet back of the main building. The urinal discharges directly into the street gutter, and is provided with no water connection for flushing. The privy proper consists of a row of seats over some kind of a cess-pool (whether concrete, brick or earth-lined, could not be ascertained), which is supposed to connect directly with the drain pipe. However this may be, this cess-pool contains a large amount of stagnant matter, which is apparently always there, up to a certain level, at which it flows out into the drain. Offensive and dangerous gases are constantly arising from this collection of filth. The drain itself must be in an exceedingly bad state, as it is only flushed with water during time of rain, and must, therefore be well coated with the solid portions of the sewerage. Such sanitary evils should not be tolerated in any large town. If they cannot be entirely removed and improved apparatus put in, they should be periodically inspected, cleaned and purified with proper disinfectants, such as a solution of copperas or quicklime.

CONCLUSION.

The sanitary precautions recommended in this report will doubtless seem to many of questionable importance, to be mere schemes of a fault-finder, designed to correct imaginary evils. And the reasons for such criticism are easily seen. The results of defective plumbing or ventilating do not show themselves so immediately, or are not so easily traced back to the original cause for this connection to be always clearly seen by any one. Cause and effect do not stand in such unmistakeable and well defined relation to each other as they do when a man is prostrated by a brick. All the numerous links of such a complicated piece of machinery as a man generally intervene, and these further complicated by the influences of all his various habits, and of the various conditions which he is subjected to. One man may

drink polluted water for weeks and months and suffer no perceptible ill effects, while another man may have an attack of fever from the same cause within a week or two; all being dependent upon his condition of health. A man may die from the effects of a bullet wound, or of a broken leg, simply because his general health had so suffered from defects in the sanitary arrangements of his house that his vital force is not sufficient or his blood is not in good enough condition for him to recover from what would be a comparatively slight injury to a healthy man.

The first effects of bad ventilation and impure air are headache and general debility, and constant occupancy of a poorly ventilated room, though not necessarily causing serious sickness, would certainly very much impair any constitution. The pale and sickly appearance of most of the pupils of this institution is doubtless largely due either to hereditary causes, to the disease which has caused their infirmity, or to their necessarily restrained life, but it is far from doubtful but what this debility is largely perpetuated by the confinement of the pupils for many hours of the day in the poorly ventilated school-rooms.

With these remarks I will conclude this report, hoping that you will pardon both its deficiencies and my delay in not preparing and sending it sooner.

Very respectfully yours,

ARTHUR WINSLOW.

REPORT OF DR. J. W. JONES, PRESIDENT, ON THE NORTH CAROLINA INSTITUTION FOR THE DEAF AND DUMB AND THE BLIND.

To R. S. TUCKER, *President Board of Trustees of the North Carolina Institution for the Deaf and Dumb and the Blind, Raleigh.*

On the 22d day of May, 1885, a Committee appointed by the North Carolina Board of Health at its annual meeting at Dur-

ham, consisting of Drs. J. W. Jones, S. H. Lyle and Arthur Winslow, Civil Engineer, visited the North Carolina Institution for the Deaf and Dumb and the Blind. The warm reception and hearty co-operation of the officers in charge of the Institution greatly impressed the Committee.

The President of the Board of Trustees of the Institution reports that there have been no deaths, but little sickness, and a reduction of twenty per cent. since his last report. This shows that the officers have been diligent and faithful.

The last report of the Physician of cases of sickness treated, and the report of the Engineer of the Board of Health, seem to show that there are local disease causations in the Institution that need to be investigated and removed.

There were under treatment during the last term, 441 cases of sickness, of which there were 11 cases of Pleurisy, 32 cases of Tonsiletis, 28 cases of Bronchitis, 16 cases of Pneumonia, 29 cases of Diarrhœa, and others which are usually considered preventable, and caused by exposure to cold.

Permit me to suggest that a better plumbing and ventilation, warmer eating, sleeping and bath-rooms might better this condition, and prevent much sickness in the Institution. In my opinion, your Physician has very properly called your attention to these subjects in his last report, and we urge the adoption of his recommendations.

In case of an epidemic of any kind, or of contagious disease which you may have at any time, there are no ways of isolating the disease and thereby of preventing its spreading, and being contracted by others. On this subject, also, your Physician's recommendations are eminently proper.

Sanitary science, as it goes on in its investigation of the laws of health, shows that these laws cannot be violated with impunity. A disregard of her laws brings disease, slowly it may be, but surely.

As our population increases and becomes more dense, increased efforts must be put forth to remove the constantly accumulating debris incident to a thickly settled civilized country. In insti-

tutions where there is a large aggregation of people in a small space, the care must be unremitting in removing all vegetable and animal matter before decomposition sets in.

The buildings should be so arranged that the inmates may have sufficiency of sunlight, clean water and pure air. The atmosphere is a great carrier, and permeates all bodies. So our bodies, our food and our water partake of its kind—good or bad. Water is the great solvent of nature, and readily takes up everything in contact with it in a soluble state. So all sources of water, as well as the ducts leading to or from them, should be studiously guarded from impurities. Also, impure air will make the water impure, and impure water will make the air impure. The sources of water are often rendered impure, and even poisonous, by impure surface water entering in through the earth, or running back into the wells or springs from some filthy sink near by. For some distance about the source of water, well or spring, absolute cleanliness should be observed.

Sunlight, the great source of life and motion, should not be shut out nor too much avoided, but its entrance so regulated that healing may be on its wings, and the weak knees and eyes be strengthened. It gives life and light. It dries and decomposes and cleans, and sets up currents of air that cool us and carry away the impure air and replace it with the pure and fresh air.

Prof. Simmons, one of the Committee, was not with us, and we feel the loss of his report.

We have the pleasure of submitting herewith the reports of Dr. S. H. Lyle and Civil Engineer Arthur Winslow. We cannot too strongly recommend a careful and considerate study of Mr. Winslow's report. On the state of the plumbing of the Institution depends very largely the health of the inmates. It is a matter of the very first importance. Mr. Winslow has done his work well, for which we thank him.

Very respectfully submitted,

J. W. JONES,

President N. C. Board of Health.

TARBORO, N. C., August 22, 1885.

REPORT OF COMMITTEE TO CONFER WITH THE BOARD OF DIRECTORS OF THE NORTH CAROLINA PENITENTIARY IN REFERENCE TO THE EXAMINATION OF PRISONERS.

RALEIGH, N. C., December 13, 1886.

J. W. JONES, M. D.,

President North Carolina Board of Health:

SIR:—Your Committee appointed at the last meeting of the State Board of Health in New Bern to confer with the authorities of the State Penitentiary in regard to obtaining better medical control of the convicts employed on work outside the Penitentiary, in the interests of humanity and with a view to diminishing the inordinate death-rate, would respectfully report:

We waited upon the Board of Directors of the Penitentiary at their regular monthly meeting in June and were received with politeness and treated with consideration and courtesy. Upon inquiry, we learned that the Physician to the Penitentiary, Dr. J. W. McGee, already made it a rule to examine every convict upon his admission, though he was not in the habit of examining critically the heart, lungs and urine of every case, but only those who complained or gave some other sign of being below par in health. We learned, however, that many convicts never entered the Penitentiary, but were sent directly to the railroads from the courts convicting them, so that they never passed under the eye of Dr. McGee at all.

We suggested that it would be best to have every convict sent to the Penitentiary before he was assigned to work, and that the Physician make it a routine practice to examine every case thoroughly, whether apparently sound or not.

A month or two later, the writer was summoned before the Board of Directors again, at the request of Dr. McGee, and the subject re-opened, no action having been taken by the Board in the meantime.

The practical difficulty in the way of having all convicts sent first to the Penitentiary was the expense. The writer then suggested that if the convicts could not be brought to the Physician to the Penitentiary, a competent man be required to go to them, making frequent visits to the camps, and employing the Assistant Physician himself, he being held responsible for the entire medical management, and paid accordingly. The Directors impressed your Committee as having the interest of the convicts at heart.

After a good deal of informal and desultory talk, your Committee came to about this conclusion:

1. That the convicts at one or more camps are not, or were not, properly treated, in all probability owing to the fact that they are under a dual government; the State furnishing the food, clothes, medicines, physician and guards, and the railroad the quarters and the *overseers.*

2. That the quarters are probably insufficient in size, thereby injuriously restricting the breathing space.

3. That the overseers are possibly, in some instances, brutal—overworking the prisoners.

4. That the physicians are not always competent.

All of which is respectfully submitted,

RICHARD H. LEWIS, M. D.,
For the Committee.

REPORT OF DR. RICHARD H. LEWIS, AND ARTHUR WINSLOW, C. E., ON THE WESTERN NORTH CAROLINA INSANE ASYLUM.

WESTERN INSANE ASYLUM,
MORGANTON, N. C., September 5th, 1885.

J. W. JONES, M. D.,
President North Carolina State Board of Health:

DEAR SIR:—In compliance with your instructions we spent two days in an examination of the sanitary condition of the

Western North Carolina Insane Asylum, and we respectfully submit the following copy of our report to the Board of Directors:

Considering the limited time and means at our disposal we cannot pretend to offer this as a complete scientific and technical exposition of the subject; but the examination which we have been able to make we deem sufficient to justify these general practical conclusions.

WATER SUPPLY.

The analysis of the water, made at the State Experiment Station, proves it to be of exceptionally good quality, which confirms our information that the source of supply is free from contamination. The minimum rate of supply is estimated to be 120 gallons per minute. We consider this ample for all present purposes. Owing, however, to a constantly growing incrustation in the supply pipe, the amount of water will probably be seriously diminished in the course of time. This incrustation is of oxide of iron, and we are disposed to regard it as a deposit of the iron held in solution originally by the water rather than as a product of the corrosion of the pipe. An analysis of a sample of the water taken at the Asylum shows it to contain carbonate of iron in solution. We think it probable that an analysis of the water at the source would prove it to contain a still larger amount. We suggest that this analysis be made, and if the supposition prove true, that all possible steps be taken to arrive at a method of eliminating this very objectionable element. The present supply of water, while ample, is, however, not found to be superabundant with the existing demands; and in view of the great sanitary importance of the unrestricted use of water, we would recommend that plans be considered for still further increasing the supply to meet the requirements of the new wing.

SEWERAGE.

We find nothing to object to in the construction and arrangement of the sewer and of the drain pipes. The ventilation of

the latter was shown by a severe test to be thoroughly effective in preventing any possible introduction of sewer-gas into the apartments. As this ventilation is secured by the draught of the smoke-stack, and as the number of openings and the area to be ventilated will be largely increased upon the occupation of the new wing, we think it possible that the draught may not be sufficient, and it would be well to thoroughly test this question at that time.

With regard to the water-closets used by the patients, we have noticed that the floors and other adjacent wood-work are generally wet with urine, &c., and emit disagreeable odors. Recognizing the impossibility of enforcing cleanliness with this class of persons, we would recommend that the floors of all water-closets in the wards be covered with some hard non-absorbent material, such as tiles (as impervious to water as obtainable), which we think would be improved for this purpose by a soaking in oil. Also that the wash boards be removed and that the partitions between the seats be rested upon iron brackets not less than six inches from the floor. In fitting up the water-closets in the male department, we think that the plans could be advantageously modified by combining the urinal and slop-hopper, whereby the expense would be diminished and greater cleanliness insured by the frequent application of hot water, thus more completely removing the urinous deposits than could be effected by the use of cold water alone, as in the urinal.

VENTILATION AND HEATING.

The system adopted we regard as admirable, and if the proper precautions are observed they are well calculated to meet all the requirements. We note, however, an exception in the case of the clothes drops, which, in some cases, are not ventilated at all. To remedy this, we would suggest an adequate opening at the top and the introduction of a steam coil near the bottom, which would prevent the vitiated air from escaping into the basement and ascending through dumb-waiter and other shafts into the apartments above. Further, we would recommend that the flues

leading from the drying-closets be completely shut off from all communication with the wards.

In view of the high and exposed location of the Asylum buildings, we think it would be a wise precaution to connect the finials with sufficient lightning-rods to protect them.

In concluding this report, we wish it to be understood by the Board that its brevity is due to the fact that only the above suggestions as to construction and arrangement have appeared necessary; to our confidence in the ability of the present management to recognize and execute any reform or improvements that may be needed in the future, and to the further fact that in the sanitary management of the Institution, as regards order, neatness and thorough cleanliness, we are unable to make any criticism other than a most favorable one.

We cannot forbear expressing our admiration of the beauty and completeness of the design as a whole, and in every detail, and of the substantial and thorough manner of its execution.

Our report would be incomplete if we failed to express our appreciation of the valuable assistance rendered us in making our examination, and of the courteous hospitality shown us by the Superintendent during our stay.

Very respectfully,

RICHARD H. LEWIS, M. D.,
ARTHUR WINSLOW,
Committee.

REPORT ON THE SANITARY CONDITION OF THE NORTH CAROLINA STATE INSANE ASYLUM.

I. HEATING AND VENTILATION.

The heating of the wards and other apartments of the building is effected by what is known as indirect radiation, which consists, briefly stated, in forcing air over steam coils into the building. The air for this use is drawn down a stack by a revolving fan, located in the boiler-house about 250 feet back of the main build-

ing. Thence it is driven through an air duct (about 7 by 6 feet in section) to the centre building, where it splits, half following an air duct under each wing, whence it flows through separate flues into the wards. As the time of our visit was in June, we were not able to judge of the effectiveness of the system. The officers of the Institution state, however, that it is defective in its operation, not supplying sufficient heated air in the winter to properly warm the wards. They are inclined to attribute this to the relative location of the fresh air stack and the fan, which, they maintain, tends rather to force air up the stack than to draw it down. The Board was not able to make a thorough examination of the fan or to test this question, but we think the conclusion a probable one. Also, the top of the stack allows of the admission of fresh air only on the north side through a lowered opening, and it is our opinion that this single opening is not sufficient to supply the fan. The object in making only one was, doubtless, to prevent the gases from the smoke-stack, which is some forty feet south of this, from being drawn in. This chimney is, however, some thirty feet higher than the fresh air stack, and we think that the east and west sides can be opened without any danger from this source. We would recommend that the efficiency of the fan, and the effect of the position of the fresh air stack, and of its openings, be carefully tested, and the defects remedied, so that a strong current of air can be forced into the building from the fan whenever needed. The efficiency of this fan is doubly important, for not only does it effect the heating of the building, but it is also the ventilator whence nearly all of the fresh air is derived in cold weather. That it should be up to requirements is hence imperative.

The fresh air duct leading from the fan to the building is about 250 feet long. It is seen that the air duct is directly over the sewer pipe and foul air pipes, and separated from them only by a plank flooring. The sewer pipe is of cast iron, and the foul air pipes of terra-cotta. Unless the former has been tested under hydraulic pressure, it is more than probable that it is not air-tight at a number of places, and gases must then escape from

it and rise with the fresh air above. With the other pipe there is less danger of this, for though terra-cotta pipes are less likely to be air-tight than is cast iron, the air in it is always rarefied and the tendency is more to suck air in than for any to escape. These pipes should be separated hermetically from the fresh air duct. Further, in connection with this duct, is to be noticed that an exceedingly inflammable material lines both the top and bottom, *i. e.*, the two plank floorings; also the top one is in close proximity to steam and hot water pipes, which must dry it most effectively. Should a fire once start in this duct, aided by the draught from the fan, it would spread with terrible rapidity. If these partitions can not be removed and replaced by some non-combustible material, the danger of the spread of fire from the duct should be lessened by putting up fireproof doors, located so as to break connection with the building; and facilities for extinguishing fire should be at hand here, supplemented by automatic sprinklers on the cold water pipes.

The branch air ducts leading under the two wings extend the entire length of the latter. They have a rough brick flooring, which could be made much less permeable to the vapors of the ground beneath by a thin covering of asphaltum. Along the bottom of the south wall of this duct are a number of small holes opening at regular intervals into an adjoining passage. The idea of these openings was, perhaps, that they should be avenues for the entrance of fresh air. With the pressure in the duct from the fan no air can, of course, enter through them, but, on the contrary, must escape by them, and doubtless accounts in part for the defective hot air current into the wards. These, and all other openings in the duct, excepting that through which the hot air is intended to flow, should be carefully closed. The steam pipes leading from the boilers to the radiators are nowhere packed. This should be done with some non-conductive material, and would result in increased efficiency of the radiators and in a saving of steam. There would also be less danger from fire. The radiators themselves are of an old pattern and could be improved upon. They are surrounded by a casing of wood,

which is too combustible a material to be so close to steam coils. The hot air is carried from the radiators by separate brick flues to the different wards. Each ward has about 20 hot air flues with openings (about 12 inches by 10 inches) equally distributed. Provision for the exit of foul air is made by exit flues leading from the chambers out into the attic of the building. The location of the openings of these flues in the chambers is bad, generally about 5 or 6 feet from the floor, and in some cases at the level and near the head of a patient's cot. Inasmuch as the hot air is the fresh air and the cooler air the foul air, the exit flues should open from near the bottom of the wall. They should also be extended to above the roof and have free communication with the open air. There is no provision for drawing out the foul air other than natural ventilation, so when hot air is not being driven in, care should be taken to force a current of cool fresh air through the wards, or to keep the windows open. Some of the chambers were noticed to have no ventilating opening, which is very objectionable, as there can be no circulation of air in such rooms.

II. DRAINAGE AND PLUMBING.

The sewage and waste water of the Asylum is conducted from the building by a system of cast-iron soil-pipes and waste pipes, opening into one central sewer under the centre building. A prominent feature of the system is the method adopted for ventilating the soil-pipes and preventing the escape of noxious gases into the building. This consists in drawing air through the soil-pipes, from a point above their connection with the main sewer, the suction being produced by means of a stack inside of the boiler-house chimney, which is connected with the sewerage system by terra-cotta foul air pipes. With this method the tops of the soil-pipes are closed, and no trap intervenes between them and the water-closet hoppers, the downward draught through the latter being intended to prevent the rise of any sewer gas into the apartment. The effectiveness of this system is, of course, entirely depend-

ent upon the heating of the boiler-house chimney: the higher its temperature the greater the draught. This chimney must, therefore, never be allowed to get cool. Further, as a chain will part at its weakest link, so will suction tend to draw air in along the line of least resistance, or through the nearest opening; therefore, the ventilation of the central or nearest pipes is apt to be accomplished at the cost of the remoter. The system has been condemned in the case of the Danvers Asylum, of Massachusetts, and of the Rhode Island State Asylum. The rough test made by the board at the North Carolina Asylum indicated, at the time, good ventilation, even at the remotest hopper, and therefore, as far as our observation went, we find nothing to object to in this respect. Any additional openings should be made, however, with great caution, as they may produce dangerous effects.

The water-closets in the wards consist of simple hoppers leading directly into the soil-pipes. They are flushed automatically from separate cisterns, at the rate of about one gallon every fifteen minutes, through a one inch pipe. The size of the service pipe and the amount of water are below the regulation amounts, but they seemed to be sufficient here. In the male wards, especially about the urinals, the floor, which is of oiled pine, is somewhat penetrated by urine, and is generally, with this class of people, evidently liable to be befouled. As a great improvement here, we would suggest that the whole floor of the privies, or, in any case, that portion surrounding the urinals, be made of cast-iron, slate, or laid with impervious tiles, sloping towards the soil-pipe, with a narrow drain and small exit pipe, so that the floors can, at any time, be liberally flushed with water.

The large sinks in the water closets empty into drain pipes leading into the sewer and are not ventilated. To prevent the escape of foul air through these sinks an  trap is introduced immediately below them. This is a necessary precaution, but to be effective it is further necessary that the drain shall either extend to and open out above the roof, or that the trap be ventilated.

The sinks used for slops in the dining-rooms lead, however, directly into the main sewer pipe without even an apology of a trap for breaking direct connection. The waste pipe extends upwards from the sewer through the different wards to the uppermost story, where it is cut off abruptly under the sink. The sinks open directly into this, so that there is not the slightest obstruction to the flow of sewer gas up through the pipe into the wards; in fact, with the heating of these tubes by hot water the conditions are in every way conducive to producing an upward current, and such current was noticed to exist where tested for. The remedy for this consists in extending the waste pipes to above the roof of the building, or leaving it open, and in inserting an S trap under each sink and one between the pipe and the sewer. Further, as grease is abundant in the water emptied into these sinks, a flush pot should be introduced beneath each. Such a pot is known as the Deuco. It consists simply of a pot with a conical base closed at the bottom by a valve which is operated by means of a rod extending through the strainer at the top. This pot is allowed to fill with water from the sink, and then the valve is opened and the whole contents rushes out with such violence and velocity that it effectively carries along all grease particles and thoroughly scours the pipe.

The waste pipes from the bath tubs in the wards are also noticeable, in that their connection with the sewer is an unbroken one. They should be trapped and ventilated.

Further is to be condemned unhesitatingly the drainage of the privies in the centre building. Here the hoppers, urinals, sinks and basins all open directly into the soil pipes without any traps, and the connection of the soil pipes and sewer is also unbroken. The ventilating current which draws out the foul air from the similar pipes in the wards has no connection with these, and does not extend its influence here at all; and the soil-pipes are not even extended to above the roof, but open out directly into the attic, at least in one case, so that these, with the hoppers and other openings, furnish the only and the most direct avenues possible for the escape of gases, whence they must diffuse them-

selves through this part of the building. This condition of affairs is to be strongly condemned. The remedies necessary are evident from foregoing remarks, and they cannot be made too soon. It is suggested to connect these soil-pipes with the foul air ventilating pipes of the wards. As already mentioned, this additional tax on the ventilating capacity of the hot chimney stack should be made with caution.

The sewage and wash water, after passing into the central pipe, is conducted along under the fresh air duct, as has been illustrated, to the extreme rear end of the building. Here, just at the door of the wash-house, the cast iron pipe ends, and connection is broken with the sewer beyond by a trap of square section. The location of this main trap so close to an occupied room, with only a plank covering, is bad, and in fact there is no need of such a trap at all. Main traps are only necessary for breaking connection between houses and foul sewers or cess-pools, and in the present case the sewer is so short and can be so easily flushed that there is no reason for it to become foul. The form of trap is also bad, it being in fact a diminutive cess-pool in which solid matter will collect at the bottom. If any trap here is thought necessary, it would be better to substitute a simple ⌣ trap, which will be washed clean with every rapid flow of water. In this case the pipe should be extended some 50 feet from the building and provided with a man-hole and opening for ventilation.

Beyond this main trap the sewage is conducted for some 200 yards in a brick-lined channel of square section, coated with cement and covered with loose stone slabs. Thence it flows into an open ditch which conducts it beyond the Asylum property and indirectly into a small stream which flows into Walnut Creek. Terra-cotta pipe would have been better than the brick channel, but the latter seems to fulfil the requirements. The open ditch is, however, bad, inasmuch as it has an irregular sloping and uneven bottom and is filled with a rank growth of weeds, which must arrest and collect much of the solid matter and promote putrefaction and the generation of poisonous gases.

Being located in a line southwesterly from the buildings, a direction from which the prevailing winds blow, this ditch is calculated to be a source of annoyance, to say the least. As a remedy for this, we would suggest that the flow of sewage be diverted from its present course in the ditch, that the fluid and solid matters be separated, by means of a filter or a tight cess-pool in which the solids will settle out, and that the fluids be used on garden or grass lots for manure when needed, and at other times be conducted by a terra-cotta pipe or other smooth channel down into Rocky Branch; the solid matter need only be covered regularly with ashes or dry earth and carted away or used in the garden. This change would result in a probable profit to the institution and in the removal of the source of nuisance.

III. WATER SUPPLY.

The water for washing purposes and for the flushing of hoppers, etc., of the Asylum is pumped into the building from a reservoir near by, which is fed from Rocky Branch, from a point about three-fourths of a mile north of the buildings. As regards the quality and quantity of this water, we find nothing to criticise. The supply of the building is, however, entirely dependent upon a single pump, which has to force all of the water from the foot of the hill to the top of the building. The pump is sufficient to meet the requirements, when it is in working order, but should any accident happen to it, or any of its parts wear out, the building would be entirely without a means of water supply, which, with its large sewerage system, would be a very serious matter. At present the engine cannot even be taken apart for an "overhauling." We consider it a very necessary precaution that the pumping plant be duplicated, as is customary elsewhere in similar cases.

The drinking-water for the Asylum is taken entirely from a well, located near the boiler-house, in the rear. An inspection of this reveals the fact that the well, which is 50 feet deep, is located within 15 feet of the main sewer trap, and only 6 feet from the sewerage conduit. This conduit, as has been already

stated, consists of a square brick channel, coated with a thin layer of cement. From what we saw, we are of the opinion that the character of the work is such that the channel is by no means impervious to water, and it is highly probable that liquid sewage escapes from it into the soil. This being the case, there is nothing to prevent the percolation of these fluids from a considerable length of the channel through the soil into the well, with the effect of seriously contaminating the water. The two are certainly in dangerous proximity. An analysis of the water of this well, made at the State Experiment Station, in 1874, showed excessive amounts of chlorine, free and albuminoid ammonia, the presence of which is thus easily to be accounted for. We would earnestly recommend the changing of this source of supply of drinking-water, either by sinking another well, remote from the building or any contaminating influences, or better by using rain-water, stored in large cisterns, which would be located so as to distribute water in pipes to the centre building.

POSSIBLE SOURCES OF MALARIA.

There is no more thoroughly established fact in sanitary science than that disease is transmitted through drinking water. While malarial diseases have not been so systematically investigated in this connection as some others, notably typhoid fever, still, a sufficient number of facts are personally known to members of the Board of Health alone to demonstrate such a relationship. One instance will suffice to show the character of the facts referred to. In a town in the eastern part of the State there lived, side by side, two large families which happened to have exactly the same number of members, children and adults. One family drank well-water which was considered as good as any in the corporate limits, the other drank inferior cistern water—rain-water caught in old wine vats. The former suffered greatly from malarial troubles, the latter not at all. And this is no more than we would expect on theoretical grounds. Malaria, whatever it is, is of telluric origin; water is the most universal solvent; well-water is of the earth, earthy; cistern water is from heaven. In

view of the above and of the further fact that the well-water used in the Asylum is not first-class drinking water, even according to chemical analysis, we think it most likely that there is to be found the cause of the malarial affections which have prevailed. It is, however, possible that the fish-ponds and the sewage distribution may not be innocent in this matter, and we would recommend that *all* of the basins of the former be kept either constantly filled with water, or better, if they are not a source of profit to the Asylum, that they be drawn off and the ground well drained.

Respectfully submitted,

J. W. JONES, M. D.
ARTHUR WINSLOW, C. E.
RICH. H. LEWIS, M. D.

REPORT ON DRINKING WATER OF RALEIGH, BY ARTHUR WINSLOW, C. E.

REPORT ON THE DRINKING WATER OF RALEIGH.

DR. J. W. JONES,

President North Carolina Board of Health, Tarboro, N. C.:

DEAR SIR:—I submit to you, herewith, a short report upon the nature and condition of the drinking water of Raleigh. It is necessarily short and largely compiled, for, with the means at our disposal, much time could not be devoted to original research. The definite facts which it contains, however, are, in my opinion, of value to the Board, and the collection of such facts from different towns in the State will put us in a position to criticise intelligently and specifically the sources of water supply throughout the State and to recommend the proper remedies where evils exist.

To this report I have appended a short paper on rain water and the construction of cisterns, which, I hope, will meet with your approval.

Very respectfully, yours, ARTHUR WINSLOW.

With two or three exceptions the drinking water of Raleigh is well water. These wells are either private wells, located within house lots, or are public wells, on the corners or sides of streets. These public wells supply a large majority of the people with their water; they are under the charge of the Street Commissioner, who sees to their being kept clean and properly walled.

The wells are walled with loose rock almost the entire length. Their average depth is between thirty and forty feet. One only reaches a depth of fifty-six feet. As a rule the top ten or twelve feet is in clay, and below this water-bearing strata of quick sand or porous gravel come in. Some wells have a rock bottom. About five or six feet of water generally stand in the bottom. With the public wells the top is cement-lined in many cases and the ground about prepared so that surface water will neither flow directly into them nor percolate through the soil.

In order to obtain definite facts concerning the wells of the town, over a hundred and twenty were visited and information obtained as to their depth, temperature and hardness of water, and their proximity to any source of contamination.

The following results were reported by Mr. W. Z. Blake, late Street Commissioner, who was engaged to make the inspection:

DEPTH.	NO. WELLS.
20 feet or less	16
Between 20 and 30 feet	32
Between 30 and 40 feet	52
Between 40 and 50 feet	20

DISTANCE FROM PRIVY OR STABLE.

DEPTH.	NO. WELLS.
50 feet or less	12
Between 50 and 100 feet	46
Between 100 and 200 feet	59
Over 200 feet	3

TEMPERATURE.

59° F. 18
60° 32
61° 32
62° 18
63° 20
Hard and not good 20

Full notes of the results of this inspection are retained, giving the location of each well. These will be of value for future use in the study of the distribution and character of well-water.

Fifty feet is certainly too short a distance for well and privy to be separated from each other, especially as a number of the above twelve wells are nearly as deep as this. The danger of contamination is, to a certain degree, offset by the fact that most of the privies are tub or dry earth closets. One hundred feet, with the clayey soil of Raleigh, may be considered a safe distance, but many of the forty-six classed under "between 50 and 100 feet distant," are only 60 or 75 feet away.

It is probable that the water of more of the wells is hard than are given in the list. Some are known to contain magnesia salts in solution, and have most disagreeable effects upon strangers, giving rise to diarrhœa, and sometimes to vomiting. These wells ought to be identified. As a rule, the well-water is considered good. Its quality varies, of course, with the weather; is apt to be clouded with sediment with heavy rains, and stronger in soluble salts after long dry spells.

It was not practicable to obtain analyses of water of our own sampling, but the following analyses had already been made at the Agricultural Experiment Station:

No.	Total solids in solution, grains per gallon.	Chlorine, grains per gallon.	Free ammonia, parts per million.	Albuminoid ammonia, parts per million.
1	8.2	.4	.13	.08
2	4.4	.2	.05	.08
3	19.2	5.2	.04	.02
4	8.0	.9	.06	.03
5	8.4	1.12	.058	.16
6	68.80	14.20	.00	.19
7	30.2	3.8	.016	.12
8	27.3	4.04	.026	.08
9	51.00	13.19	.026	.21
10	20.90	3.72	very small	very small
11	7.19	.44	none	none
12	1.3	.34	.692	.13

Taking two grains of chlorine per gallon, two parts of free ammonia per million, and one part of albuminoid ammonia per million, as the maximum amounts which a well-water should contain to be declared pure, we see that Nos. 3, 6, 7, 8, 9 and 10 are suspicious, and 6 and 9 certainly to be condemned.

No. 12 is the result of the analysis of melted ice from the factory. The high ammonia per cent. is doubtless to be attributed to the ammonia used in the process.

These well-waters cannot, however, be considered as representing the average Raleigh water, as a number of them are from wells whose purity was suspected. It is, however, probable that there are many others of the same character as these. The rough, preliminary sanitary inspection which we have been able to make proves, however, that there are few if any glaring instances of well contamination. Impurity of well water, if it exist, is due to either some hidden source or dissolved mineral matter which only analysis will reveal.

ON THE USE OF RAIN-WATER AND THE CONSTRUCTION OF CISTERNS.

BY ARTHUR WINSLOW, C. E.

In country places and small towns rain-water ranks among the purest and best for all household uses. Wherever there is any suspicion of the contamination of well-water, the rain should be collected from the roofs of buildings and saved. There is considerable evidence going to show that in many cases *malaria* is due to the character of the well-waters. Not only is rain-water a healthy water, but it is an exceedingly soft water, and therefore excellent for cooking and washing purposes, and, where a hard water is habitually used, the saving of soap through the use of rain-water will amount to a considerable item.

Rain-water is, however, not absolutely pure. Near manufacturing centres and in cities it contains soot and acid fumes, impurities washed from the atmosphere. Further, the accumulation of dust, leaves, etc., on roofs affects the purity of the water, and where saved, care should be taken to keep the roof as clean as possible. The character of the roof has also some influence, whether of new or old shingles, whether lead-painted or not.

Rain-water is collected in cisterns located sometimes near the top of the house and drawn off through pipes, or located in the ground and pumped out for use. When in the house the tanks are frequently of lead, which is, however, an objectionable material, as lead is often attacked, by soft and pure waters especially, and the water made poisonous. Galvanized iron, or, better, iron coated with coal-tar paint, is much to be preferred, is more durable and is cheaper. Stone-ware and slate are excellent materials in themselves, but the joints between the slabs should not be filled with red lead. Wooden receptacles are difficult to keep clean and liable to decay. Such tanks should be constructed so as to be self-cleansing, and should not have a direct connection through the overflow pipe with a cess-pool or drain.

Very often, however, and perhaps most generally here, cisterns are built in the ground. An essential of such cisterns is that they be impervious. Their dimensions vary, of course, according to requirements. The excavation should be dug square and about 9 inches deeper than the bottom of the cistern is to be, and about 8 inches clear of the side walls. Then, the entire bottom of the pit, which should be smooth and hard, is covered with damp clay about 6 inches thick, well compacted. Over this a layer of hydraulic cement, an inch or more thick, is spread and allowed to harden. Upon this the bottom bricks of the cistern are laid in fresh cement mortar and over these again a layer of cement spread about half an inch thick. In wet, soft or loose ground a plank flooring beneath the cement and bricks may be necessary. Upon this foundation the walls of the cistern are built of brick laid in cement mortar. With the progress of the wall the outside should be coated with a layer of cement, and, as this hardens, clay should be rammed into the space behind. The walls should be extended to about a foot above the ground, and near the top two or three openings should be left on each side for the admission of air, and covered with a grating or wire netting. Also an opening at a lower level than these for the escape of overflow. The entire inside surfaces of the walls should next be coated with a smooth, thin layer of cement. The top should be roofed over and the pump introduced through the roof, the pipe of which should extend to within about a foot of the bottom. Cisterns should be cleaned out certainly once every two years. To secure a supply of water during such time of cleaning, and for other purposes, it is desirable to divide the cistern into two compartments of unequal size, by a brick wall laid in cement mortar and made impervious by a coating of cement. This wall is built about 18 inches lower than the others, and the water, being introduced about 2 feet from the bottom of the first and another compartment, rises and overflows the partition into the second. In towns or other places where rain-water contains impurities, it should be filtered. Animal charcoal is one of the best filtering

materials, and others, such as carbide of iron, spongy iron, etc., are used. But probably the most easily obtained is gravel and coarse, clean sand, which are all sufficient for the purposes in view. A wood grating or platform with holes or narrow slits, is built across the larger compartment 2 feet or more below the top of the dividing wall. Upon this, perforated tiles are spread, in close contact, or, if these are not available, a layer of porous brick, laid dry, will answer. Upon this 3 or 4 inches of gravel of uniform size and then some eight inches of coarse sand which has been washed free from clay, are spread, and then another layer of perforated tile, porous brick or a sheet of punctured, tar-coated iron is laid, with a slight slope from the dividing wall, which will prevent the overflow from the first compartment from washing out the sand and will distribute the water well over the filter. By this arrangement, the heavier compartments settle out in the first compartment and the finer particles are arrested on the filter, and as the water is drawn off below, the sand has opportunity to dry and to absorb air, which is essential for it to retain full efficiency as a filter. As it becomes clogged with sediment the top layer must be scraped off and at intervals it will be necessary to remove all of the sand and replace it by a fresh supply. When difficulty is experienced from vegetable growth upon the surface of the sand, or from freezing in winter, the filter must be lowered so that it will be almost always covered with a foot or two of water.

CAPE FEAR RIVER AS A SOURCE OF WATER SUPPLY.

THOMAS F. WOOD, M. D.

Southern river water of the type of Dismal Swamp water—water of a clear yellowish hue, known also as juniper and cypress swamp water, stained by flowing through a peaty soil,

has for a long time been held in high esteem by masters of vessels for supplies for long voyages. The current belief is that this water after long storage in casks and tanks undergoes a process of rectification which insures its keeping properties indefinitely.

It is the purpose of this paper to set forth the experiences in the employment of a water of the Dismal Swamp type, taken from the north-east branch of the Cape Fear River, as a source of public supply, covering observations extending over a series of years. The Clarendon Water Works has a pumping station on the east shore of this river, from which is taken the water which supplies the city of Wilmington.

It will be necessary to give a brief description of the North-east River, in order to get a sufficient knowledge of the character of this water. This river rises in Duplin county, and in its course flows through a country only a few feet above the sea-level. It drains an area of about 1470 square miles, comprising the counties of Duplin, Pender and New Hanover. The river and creeks tributary to it have swampy margins, draining cypress swamps of large extent. Cypress swamps are not exclusively wooded with cypress trees, as the name would imply, but pines (*Pinus resinosa*), black-gums (*Nyssa*), sweet-gums (*Liquidambra styraciflua*), and dense undergrowths of smilax, andromedas, ilexes, also abound. One of the largest tributaries—Smith's Creek and its branches—has its source about five miles from Wilmington. The river is about 450 feet wide at the pumping station of the water works. The tide rises to a point 40 miles beyond Wilmington, making in all 75 miles from the ocean. The average rise of the tide at the station is 3.75 feet. Directly opposite the pumping station, and for 500 yards below it, tide-water rice-fields skirt the river down to Point Peter, the junction of the north-east with the north-west or main branch of the Cape Fear River. Above the station two other rice-fields are located, deriving their tidal irrigation from the river.

Wilmington is located on the east side of the Cape Fear River proper, with a water-front of two miles. The town is built upon

a series of sand dunes, with intervening brooks, the natural drainage, and most of these streams have been converted first into partially-covered drains, and finally made to serve the double purpose of drains and sewers. These discharge their contents into the docks along the river front. The sewer which discharges nearest to the pumping station is ———— distant. The number of sewers discharging into the river front is ———, and the number of families using these sewers ———, and in addition to them two small hotels. The drainage of the east side is accomplished by a series of open ditches and natural streams. These streams and ditches eventually empty into Smith's Creek, a tributary of the Northeast River. On these streams are located four cemeteries, in varying degrees of proximity, and one or more slaughter-houses. By the course of these streams about one-half or two thirds of the town is engirdled, and the natural course of drainage east and west is directly or indirectly into the Cape Fear or its tributaries.

Cape Fear River water has been studied from many points of view, but not systematically, because the business interests involved were by no means identical with the sanitary interests.

SOURCES OF CONTAMINATION.

The amount of sewage matter which is emptied into the Cape Fear River has never been made apparent by chemical examination of water taken at the pumping station. The following table of analyses made, while small, may be taken as an average of the albuminoid ammonia and chlorine. The analyses were done at the Agricultural Department of the State, after the Wanklyn method.

TIME.	Total Solids. Grs. per gallon.	Chlorine. Grs. per gallon.	Free Ammonia. Parts per Mill'n.	Albuminoid A. Parts per Mill'n.
1881.				
Feb. 24.	6.2	0.6	0.05	0.26
1882.				
Aug. 30.	9.10	0.52	0.014	0.50
Aug. 30.	11.10	0.53	0.04	0.36
Sept. 18.	6.70	0.23	0.08	0.48
Sept. 18.	10.60	0 69	0.24	0.24
Sept. 18.	7.40	0.29	0.08	0.40
Nov. 21.	6.90	1.31	.....	0.10
Nov. 21.	7.50	0.49	.....	0.20
Nov. 21.	9.60	0.45	.....	0.46
Nov. 21.	8.20	0.48	.....	0.42

Sewage contamination may almost be excluded by the above showing, and the nitrogenous element, as small as it is, may be accounted for by the decomposition of vegetable matter. One source of vegetable decomposition is from the discharge of water from the rice-fields during the "short" and "long flow."

The "short flow" is the technical name for the flooding which is first employed for the germination of seed. The water is let in through flood-gates at high tide, so that it covers the rice about four inches, and kept in this state until the seed germinate. The "long flow" is the admission of water in the same manner as above, and is intended to kill the grass after the first hoeing of the young rice. The water is just deep enough to hasten growth and decomposition under the influence of early spring sun, and consequently a large amount of water laden with the products of decomposition is discharged into the river. Another washing is resorted to, by admitting one tide into the rice-field trunks and ditches to give them a thorough cleansing. The soil of tide-water rice-fields consists of deposits brought down by freshets from the hill country, which have been deposited layer by layer. It consists largely of organic matter, and supports a very rank growth of grasses, sedges, and succulent aquatic plants, such as sagittaria and orontium.

FACTORIES.

There is no pollution from factories along the river front, the gas-house being the only establishment which discharges its contents into the river. Sulphuretted hydrogen has been discovered in the river opposite Castle Street dock, at which point the gas-house is located.

TAR, CRUDE TURPENTINE AND SPIRITS OF TURPENTINE.

These articles may not be classed under the head of contaminating agents, but may prove a source of perplexity, as will be shown further on. For a century the products of the pine-tree have been shipped from this port, and by the accidents of handling and shipping an unnumbered amount of barrels have been lost in the river. Of these, tar and crude turpentine are most tenacious when sunk in the river-bed of mud to the depth of twenty to thirty feet. The abundance of the accumulations of these products in the river may be illustrated by the following simple experiment: On a calm day in summer, if a pole be shoved deeply into the mud and the mud stirred, very soon there follows a play of iridescent film upon the surface, emitting a distinct odor of tar and turpentine. These matters, if at all noxious or noisome, are fortunately insoluble.

THE TEMPERATURE OF THE WATER AND ATMOSPHERE.

The purity of river water must be largely influenced by the variations of temperature, and especially do high temperatures promote decomposition and increase the solvent power of water. Mr. John C. Chase, Superintendent of Clarendon Water Works, has kept the record of the temperature of the water and atmosphere. The lowest temperature of water was February 21st, 43° F., the atmosphere being the same day at the lowest, 33° F. The highest temperature attained was July 23d, when the water registered 83° F., and the air the same day 96° F. This was the highest temperature of the air for the year, although there is a higher record for water—viz., 86° F., twice in August.

TABLES SHOWING RELATIVE TEMPERATURE OF AIR AND WATER AT THE PUMPING STATION OF THE CLARENDON WATER WORKS, FROM MARCH 1, 1884, TO NOVEMBER 23, 1885. TAKEN AT 12 O'CLOCK.

	1884. March.		1884. April.		1884. May.		1884. June.		1884. July.		1884. August.	
Date.	A.	W.	A.	W.	A.	W.	A.	W.	A.	W.	A.	W.
1	43	48	78	60	79	63	75	75	82	79	86	83
2	45	49	76	60	84	64	74	74	78	78	82	82
3	50	49	43	61	83	64	79	73	86	78	88	82
4	40	48	48	60	86	65	83	73	79	78	79	81
5	65	48	70	60	87	66	85	73	86	78	88	82
6	67	49	64	61	86	66	86	74	86	78	80	81
7	68	49	66	61	84	67	85	74	86	78	87	81
8	76	50	74	61	88	68	86	75	81	77	86	81
9	72	50	57	61	80	68	82	75	83	78	79	80
10	46	50	58	61	78	69	84	75	86	78	76	80
11	70	51	58	60	86	69	84	76	75	77	78	79
12	74	51	65	60	81	70	83	76	88	78	81	79
13	49	50	67	61	87	70	84	77	96	78	76	79
14	52	51	66	60	88	71	78	77	91	79	82	79
15	52	51	62	61	76	71	77	78	92	80	83	78
16	58	52	80	62	78	72	78	78	93	80	85	78
17	68	52	68	62	76	72	79	78	85	81	82	78
18	65	53	72	63	82	72	87	78	89	81	83	78
19	75	53	72	63	86	73	86	78	86	81	89	78
20	72	54	75	64	84	73	88	78	87	81	89	79
21	68	54	66	64	85	74	91	79	85	81	89	79
22	68	55	58	63	88	74	88	79	88	82	89	79
23	64	55	60	63	86	75	85	79	92	82	87	79
24	74	56	59	62	89	75	80	79	94	82	92	80
25	80	56	64	62	88	76	85	78	94	82	85	80
26	70	57	68	61	83	76	86	78	90	82	85	80
27	68	57	74	61	79	77	73	79	88	82	81	81
28	75	58	82	62	79	77	74	78	81	82	86	81
29	72	58	82	62	73	77	75	78	85	83	88	82
30	63	59	78	62	72	76	83	78	90	83	90	83
31	58	59	.....	.....	77	76	.....	.....	88	83	92	83

Date.	1884. September.		1884. October.		1884. November.		1884. December.		1885. January.		1885. February.	
	A.	W.	A.	W.	A.	W.	A.	W.	A.	W.	A.	W.
1	85	83	87	76	69	66	53	57	72	49	52	47
2	84	84	88	77	76	66	53	57	38	49	42	47
3	86	83	84	78	70	66	52	56	37	48	58	47
4	88	83	86	79	74	65	60	55	40	48	57	47
5	86	82	89	80	61	64	62	55	55	47	56	47
6	86	82	92	81	53	63	74	54	71	47	44	47
7	89	82	87	80	53	62	65	55	54	47	67	47
8	86	82	76	79	59	62	64	55	55	48	56	48
9	86	82	80	79	66	61	65	56	65	48	62	48
10	83	81	78	79	68	61	65	56	58	49	46	48
11	79	81	76	79	70	61	65	56	66	49	27	48
12	74	80	83	78	71	61	72	56	67	50	44	48
13	78	80	82	78	74	61	55	56	58	50	36	47
14	72	79	77	77	66	61	53	56	55	50	37	46
15	77	79	66	76	70	61	70	56	70	50	37	45
16	81	79	75	76	69	60	51	55	74	51	48	45
17	83	78	75	75	65	60	62	55	48	50	48	45
18	84	78	76	75	71	59	52	54	36	50	52	44
19	79	77	75	74	69	59	24	50	35	49	36	43
20	86	77	75	74	53	58	29	49	38	49	34	42
21	83	76	76	73	58	58	48	49	41	48	33	42
22	82	76	81	73	69	59	64	49	34	48	41	43
23	82	75	69	72	69	58	53	49	34	48	36	42
24	82	75	54	71	55	58	42	49	61	48	48	42
25	83	74	66	70	53	58	45	49	56	48	45	43
26	84	74	67	70	62	58	32	48	43	49	43	43
27	82	75	75	69	64	58	38	48	52	49	50	44
28	88	75	82	69	66	58	48	48	55	48	60	44
29	88	76	74	68	59	58	64	48	40	47	.....	.....
30	89	76	66	68	60	58	69	48	62	47	.....	.....
31	....	.....	57	66	.....	.....	74	48	53	46	.....	.....

Date.	1885. March.		1885. April.		1885. May.		1885. June.		1885. July.		1885. August.	
	A.	W.	A.	W.	A.	W.	A.	W.	A.	W.	A.	W.
1	63	45	76	53	78	67	81	77	77	80	90	.....
2	49	45	72	54	70	67	88	78	79	80	84	.....
3	57	46	69	54	70	68	88	78	83	80	89	.....
4	67	47	60	55	76	68	85	78	86	80	86	.....
5	55	47	57	55	79	69	88	78	82	81	90	.....
6	57	47	76	56	69	69	77	77	90	81	91	.....
7	60	48	76	57	83	70	85	77	91	82	92	.....
8	47	48	74	57	80	70	87	77	92	82	88	.....
9	43	48	62	58	78	71	77	77	93	82	87	.....
10	63	49	49	59	67	70	68	76	92	82	87	.....
11	58	49	60	59	72	70	76	76	91	82	92	.....
12	52	50	63	60	74	70	82	75	85	82	91	.....
13	43	50	63	60	69	70	83	75	85	82	92	.....
14	46	50	54	60	69	70	88	76	86	82	88	.....
15	66	50	68	61	75	70	87	76	89	82	79	.....
16	52	51	81	61	78	71	87	77	89	82	82	.....
17	...	...	62	61	66	70	84	77	87	83	88	.....
18	34	51	58	61	73	70	78	78	90	83	86	.....
19	52	51	68	61	81	70	81	78	85	83	91	.....
20	44	51	72	61	83	71	83	79	76	83	91	.....
21	48	51	75	62	87	71	86	79	91	83	90	.....
22	38	50	81	62	85	72	89	79	92	83	90	.....
23	36	50	83	63	84	72	88	79	96	83	84	.....
24	43	50	83	63	85	73	81	79	90	83	86	.....
25	60	49	83	64	89	74	82	79	89	83	90	.....
26	64	50	84	64	88	74	89	79	92	84	81	.....
27	62	50	76	65	86	75	87	79	91	84	75	.....
28	67	50	76	65	83	75	88	80	91	84	79	.....
29	43	51	76	66	82	76	90	81	91	84	84	.....
30	56	51	77	66	82	76	77	81	91	85	73	.....
31	71	52	...	...	86	77	...	...	90	85	71	.....

Date.	1885. September.		1885. October.		1885. November.	
	A.	W.	A.	W.	A.	W.
1	82	83	70	73	74	63
2	77	82	70	72	59	62
3	85	82	82	72	52	61
4	82	81	75	72	64	61
5	83	81	69	72	78	61
6	75	81	57	71	79	61
7	78	81	66	71	81	61
8	84	80	73	70	72	62
9	88	80	66	69	61	62
10	84	79	76	69	57	61
11	82	79	64	68	65	61
12	85	79	67	68	74	61
13	86	79	66	68	75	62
14	86	79	72	68	61	62
15	84	79	76	68	58	61
16	89	79	72	68	65	61
17	84	80	76	68	58	61
18	81	80	76	68	65	61
19	82	80	81	68	73	60
20	83	80	80	68	65	60
21	71	80	80	68	53	59
22	68	79	58	67	68	59
23	70	79	59	67	70	58
24	72	78	63	66	.....	.....
25	82	77	64	65	.....	.....
26	79	77	64	64	.....	.....
27	76	76	70	64	.....	.....
28	81	75	68	64	.....	.....
29	76	74	70	64	.....	.....
30	78	74	64	64	.....	.....
31	.....	.....	54	63	.....	.....

Date.	1885. March.		1885. April.		1885. May.		1885. June.		1885. July.		1885. August.	
	A.	W.	A.	W.	A.	W.	A.	W.	A.	W.	A.	W.
1	63	45	76	53	78	67	81	77	77	80	90	.....
2	49	45	72	54	70	67	88	78	79	80	84	.....
3	57	46	69	54	70	68	88	78	83	80	89	.....
4	67	47	60	55	76	68	85	78	86	80	86	.....
5	55	47	57	55	79	69	88	78	82	81	90	.....
6	57	47	76	56	69	69	77	77	90	81	91	.....
7	60	48	76	57	83	70	85	77	91	82	92	.....
8	47	48	74	57	80	70	87	77	92	82	88	.....
9	43	48	62	58	78	71	77	77	93	82	87	.....
10	63	49	49	59	67	70	68	76	92	82	87	.....
11	58	49	60	59	72	70	76	76	91	82	92	.....
12	52	50	63	60	74	70	82	75	85	82	91	.....
13	43	50	63	60	69	70	83	75	85	82	92	.....
14	46	50	54	60	69	70	88	76	86	82	88	.....
15	66	50	68	61	75	70	87	76	89	82	79	.....
16	52	51	81	61	78	71	87	77	89	82	82	.....
17	...	...	62	61	66	70	84	77	87	83	88	.....
18	34	51	58	61	73	70	78	78	90	83	86	.....
19	52	51	68	61	81	70	81	78	85	83	91	.....
20	44	51	72	61	83	71	83	79	76	83	91	.....
21	48	51	75	62	87	71	86	79	91	83	90	.....
22	38	50	81	62	85	72	89	79	92	83	90	.....
23	36	50	83	63	84	72	88	79	96	83	84	.....
24	43	50	83	63	85	73	81	79	90	83	86	.....
25	60	49	83	64	89	74	82	79	89	83	90	.....
26	64	50	84	64	88	74	89	79	92	84	81	.....
27	62	50	76	65	86	75	87	79	91	84	75	.....
28	67	50	76	65	83	75	88	80	91	84	79	.....
29	43	51	76	66	82	76	90	81	91	84	84	.....
30	56	51	77	66	82	76	77	81	91	85	73	.....
31	71	52	...	...	86	77	...	...	90	85	71	.....

	1885. September.		1885. October.		1885. November.	
Date.	A.	W.	A.	W.	A.	W.
1	82	83	70	73	74	63
2	77	82	70	72	59	62
3	85	82	82	72	52	61
4	82	81	75	72	64	61
5	83	81	69	72	78	61
6	75	81	57	71	79	61
7	78	81	66	71	81	61
8	84	80	73	70	72	62
9	88	80	66	69	61	62
10	84	79	76	69	57	61
11	82	79	64	68	65	61
12	85	79	67	68	74	61
13	86	79	66	68	75	62
14	86	79	72	68	61	62
15	84	79	76	68	58	61
16	89	79	72	68	65	61
17	84	80	76	68	58	61
18	81	80	76	68	65	61
19	82	80	81	68	73	60
20	83	80	80	68	65	60
21	71	80	80	68	53	59
22	68	79	58	67	68	59
23	70	79	59	67	70	58
24	72	78	63	66	.....	.....
25	82	77	64	65	.....	.....
26	79	77	64	64	.....	.....
27	76	76	70	64	.....	.....
28	81	75	68	64	.....	.....
29	76	74	70	64	.....	.....
30	78	74	64	64	.....	.....
31	.....	.....	54	63	.....	.....

DESCRIPTION OF THE WATER.

This water is generally clear, and has a color from pale to deep amber, which color is not discharged by sedimentation. It is free from odor either when allowed free access to the air or after bottling or closing up in casks for years. The sediment is a finely divided mud, chiefly consisting of silica and alumina. It has the merest trace of lime or other mineral constituents.

The exception to this last statement is that during long protracted droughts the access of brackish water at Wilmington from the ocean—thirty miles away—is sufficient to allure crabs, shrimps and mullets into the water at this point. During such seasons, while there has been an amount of salt as high as fifty or sixty grains to the gallon, no saline taste was imparted.

THE COLORING MATTER IN THE WATER

is one of the marked peculiarities, and in some respects one of the gravest objections to its use for manufacturing purposes, and making it also unattractive for household purposes. The source of the coloring matter is the decomposing leaves, the roots of many trees, such as the pine and cypress, and such matters as are washed out from peaty soil. The latter alone, which is but a soil containing highly carbonized remains of leaves, roots, sphagnum, moss, etc., may impart this color to the water. It is not possible by ordinary filtration to discharge this color without the aid of chemicals, and, as before stated, sedimentation has no effect upon it.

The keeping properties of this water when confined for a long time in closed vessels is probably due to the very ingredient which gives it its color. This theory is consonant with practical experiences in the employment of vegetable substances, such as salicylic acid for the prevention and arrest of fermentation.

FILTRATION.

Filtration has been experimented with upon a large scale, the desideratum, of course, being to deliver a "white" water in the

mains to consumers. As mentioned before, filtration and sedimentation, without the employment of chemicals, did not change the color of the water, and practically was not worth the expense involved. The basis of all the experiments was the property that commercial alum had in depriving the water of its color. The process consists in passing a volume of water through white sand, at the same time causing a solution of alum and a small portion of lime to filter through with the water. The water discharged when the proportion of the chemicals was correctly adjusted was white, odorless and tasteless. It was discovered that this filtered water, although not having any taste of alum, could be used upon an unfiltered bulk of water and still exert a degree of decoloration. One sample of this filtered water may serve to convey an idea. Chemical analysis gave the following:

	Grains per gallon.
Total solids	10.35
Consisting of chlorine	1.57
Volatile organic matter	1.45
Alumina (equivalent to 5.35 grains)	.65
Sulphuric acid (equivalent to 6.07 grains)	....

Another specimen of unfiltered water from the same source as above gave:

	Grains per gallon.
Total solids	11.18
Solids in supension	.10
Chlorine	2.50
Volatile organic matter	2.88
Alumina (equivalent to alum, .8234 grains)	.10
Sulphuric acid (equivalent to alum, 1.13 grains)	.47

Deducting the alumina and sulphuric acid equivalents of alum naturally existing from the above, it gives 9.46 grains per gallon, and, small as this is, it still possesses the property of coagulating and precipitating unfiltered water. The amount of alum so far used is too large, both in an economical point of view and chemically, to produce perfect results. It will probably be ascertained that the process of decoloration will be more economically and

effectively accomplished in large settling basins, the chemical action going on more thoroughly in still water, after the alum is thoroughly mixed. The application of alum as above is not a new process, for it has been used as a domestic remedy for undrinkable water in Richmond and other cities where turbid river water is frequently delivered for consumption. None of the patented filters so far prove satisfactory on the large scale, although a few have succeeded in giving a very good result for domestic purposes. Numerous experiments are being pursued with good promise of success, and when that day comes Southern tide-water rivers will be far more valued for public supply.

AN ACCIDENTAL CHEMICAL EXPERIMENT ON A LARGE SCALE.

During this year an ice factory was erected at Wilmington. The question of water supply in proximity to transportation was the practical fact upon which the success of the venture depended. The factory was located on the Wilmington and Weldon Railroad, near the foot of a deep cut, down which a good stream of water flowed from a spring tapped in cutting the roadway through a sandhill. This water it was hoped would be adequate to the demand, but in the meantime river water, as delivered to consumers in Wilmington, was submitted to a chemist for his opinion as to its fitness for the purpose of ice-making, after distillation. The reply of the chemist was in the affirmative. The experiences of the manufacturer are intelligently written and are here submitted:

WILMINGTON, N. C., November 21, 1885.

Dr. T. F. Wood:

DEAR SIR:—We use what is known as the ammonia absorption process for making ice. We take ordinary aqua ammonia, 26° B., and distil off the ammonia gas at a pressure of 180 pounds. We pass this gas through 1700 feet of piping submerged in cool water; there the gas, under 180 pounds' pressure, liquifies. We then liberate the liquid gas into 3000 feet of iron pipe, submerged in strong salt-brine (90°), into which brine we

set the cans containing the water to be frozen. The instant the liquid (anhydrous ammonia) is liberated it turns into gas, and as the gas expands it absorbs the heat from the salt water, that in turn taking the heat from the water in the cans, making ice. The gas discharges from the 3000 feet of pipe into what is known as an absorber, containing a quantity of pipe, through which water constantly flows. The heat that is taken up by the gas is there absorbed by the water and discharged with it, the gas becoming aqua ammonia again. The cans in which the ice is frozen are placed in the freezing-tank containing the salt brine, and filled with distilled water. The freezing begins around the outside of the cans and at the bottom and continues to the centre, the grain of the ice tending to the centre from all sides. It takes 48 hours to freeze one can solid, and we have 204 cans under process of freezing all the time. After being in twenty-four hours the ice is about five inches thick on all sides of the can. The top end is the last part to freeze. The blocks of ice weigh 225 pounds.

I first used the river water for making ice. Frozen in its natural state, the ice is dark and unsightly. I tried condensing a gallon, using an ordinary tea-kettle for boiler, and condensed the steam in a tin funnel about two feet long. The condensed water thus obtained was white, and to taste and analysis pure. We used the river water for about a week, when I noticed the condensed water had a green cast and a peculiar taste, which was attributed to the iron, as our boiler was new, of forty-horse power, and the steam being condensed passed through nearly 2000 feet of pipe. That was new. This taste intensified rather than diminished as we proceeded, and the water showed more color. All this time—about two weeks—we "blew" the boiler every four hours, about 500 gallons of water being discharged from the boiler each time. As an experiment, we ran twenty-four hours without blowing the boiler, by which time the condensed water had assumed a decidedly green cast, and made green ice, not as highly colored as grass, but decidedly green. We then shut down and blew all the water out of the boiler. This water

was the color of lye, exceedingly soft to the hand, smarting severely when it came in contact with a cut or bruised place on the skin, and killed a number of eels in the small stream into which it discharged. We then filled the boiler with water taken from this stream and went to work again, when we made ice as clear as crystal, and the ice and condensed water were absolutely free from taste.

The temperature of this water increased as the summer advanced, and we saw clearly that cooler water was an absolute necessity, and we proceeded to dig a well. In order to expedite the work, we had to take up our suction pipe to rig a siphon, forcing us to use again the river water, and this time for six weeks. We soon observed the same taste and peculiarity of the condensed water, and in order to overcome the difficulty, if possible, blew the boiler every *two* hours. Still the same taste. Three weeks of steady work developed another change. The ice came out with a decidedly colored core in the centre, which core, when cut open, emitted a strong woody or creosote smell. This core gradually grew from an inch in diameter to four inches in diameter, and with the increase in size came a corresponding increase in taste and smell—so strong, indeed, as to lead a good many persons to believe the ice to be impregnated with creosote. I cut the core out of one block, and melted it in a clean bucket. The water so obtained was of a more decidedly greenish cast than the river water, with a very strong taste of wood or creosote. The odor was very similar to decayed cypress or juniper. We carry 100 to 110 pounds of steam on our boiler. This gives a temperature in the boiler of from 350° to 400° of heat, of course causing destructive distillation. I should not forget to mention that during the process of freezing first would appear an oily substance on top of the water, which gradually assumed a dark color; by the time six inches of ice had formed this substance would be in a mass about the centre of the water, and also line the inside of the ice from the bottom to the top, evidently being expelled from the water by the process of freezing. When the block of ice was nearly solid it would appear on top of the water

in a small round patch about the size of an ordinary tea-cup. We finished our well after six weeks' use of the river water. From the well we obtain white water, and have ever since made translucent ice, absolutely free from taste—proving conclusively that the trouble was from the water and not from the machine, and that the destructive distillation made apparent impurities in the river water not developed by chemical analysis.

Yours truly,

WILLIAM E. WORTH.

This very expensive involuntary experiment brought to light qualities of the Cape Fear River water and its sediment which had never before been a matter of conjecture. The distillation of the first few days yielded a clear, good water, but as the sediment accumulated in the boiler, distillation at 350° to 400° F. sent over in vapor a tar product, which imparted to the ice a peculiar taste of creosote. This product collected from the water while in the freezing bath was brown, in globules, of a pungent odor, only slightly soluble in cold or boiling alcohol and in chloroform. In freezing it imparted to the ice a cloudy streak, radiating from the centre of the block. The taste of this part of the ice was very unpleasant, but it did not permeate the whole block, and the line of contamination could be easily traced, so that in sending it out to consumers this part was chipped out.

There are two explanations of the source of this tarry product. I think it was demonstrated by the manufacturer that the error did not take place in the process of making, as all contamination ceased as soon as other water was substituted for river water. Of the two sources of the tar product occurring in the condensed water it may be that the peaty sediment which accumulated in the boiler might have furnished it. It is more highly probable, though, that the mud of the river, long impregnated with tar and turpentine, precipitating and accumulating in the boiler, yielded under destructive distillation at 400° F. the product in question.

This paper has been presented to show some of the difficulties to be overcome in locating a source of public water supply in the south Atlantic seaboard. The waters of the lakes and ponds are quite similar to the rivers, and it is a very exceptional pond or lake or spring in this locality that would furnish a white water in sufficient quantity for public supply. Sewage contamination is not a difficulty of immediate, but rather of prospective importance, and, because of the sparseness of Southern population, more easily controlled.

The high temperature, though, which running streams attain—86° F. and higher, no doubt, if a sufficient number of observations were made—shows how large an element of decomposition is at work during the prolonged hot weather, suggesting the great importance of excluding decomposable matter from the source of water supply, and the additional precaution of securing water from the deepest streams or ponds.

The chief obstacle to a wise selection of a water supply is the money element, which at a very early period of the agitation of the question of water works enters into and controls the project. The question is very seldom a sanitary one, but one of profit to investors. Some of our Southern towns contemplating water works could well study the experience of other Southern towns that have already established a water supply. They will find that public opinion and sanitary advice have seldom influenced the course of a water works company, and just now more than one Southern city is perplexed with the difficulties brought upon them by false steps taken in the selection of their source of supply.

There is still another aspect of the question of Southern water supply which I will merely touch upon at present—the practicability of deep wells as a substitute for river water. Several Southern cities have succeeded in getting artesian water, but none so far of sufficient purity to be unobjectionable. As far as the experience in Wilmington goes, the water from deep wells is very hard, with the exception of the one dug by Mr. Worth. This water is somewhat hard, but in the hottest days the tem-

perature of it was at an average of 63° F., a feature of superiority over the river water, to say nothing of its freedom from organic impurities.

REPORT OF THE WAKE COUNTY BOARD OF HEALTH ON WATER SUPPLY FOR THE CITY OF RALEIGH.

To the Board of Health of Wake County:

GENTLEMEN:—The committee appointed by your honorable body to gather all facts bearing upon the present purity and possible future contamination of the waters of Walnut Creek, beg leave to submit the following report:

We have made a careful personal inspection of the stream, its tributaries and its water shed, from the head waters in Cary to the Rocky Hole, the latter being the place from which the city proposes to take its water supply. The dates of our visits are Tuesday, September 14th, Monday, September 27th, Monday, October 4th, Monday, October 18th, and Thursday, October 21st. The portion of creek examined is about eight miles long, quite crooked, with now and then long stretches of sluggish water, and is fed by several branches, among which may be mentioned Reedy Fork, Lynn's, Simmons', Bushy and Stony. The drainage area is partially wooded and partially cultivated, and according to Mr. Arthur Winslow, is about 18 square miles. We found that about one-fourth of the town of Cary drained into the creek, the excrement of about one hundred people being cast daily upon the water shed in close proximity to the stream, including the excrement of about 30 to 40 people which was daily dropped through a privy immediately into its head-waters, a small branch which has its origin in a spring in a tobacco factory and flows slowly through a portion of the town. We learned from a physician practicing in the village that during this sum-

mer several cases of typhoid fever had occurred on the watershed of the stream—one case being under treatment at the time of our visit. From Cary to Yates's pond there is, in our opinion, no obvious source of contamination. At Yates's mill, 4½ miles from the city, we found a pond of long standing and considerable size, its bottom and sloping banks covering a large area, and very objectionable, being full of decomposing vegetable matter and making a trap for catching and propagating disease germs brought down by storm-water. From Yates's pond to Rocky Hole we could discover nothing of special importance bearing upon the pollution of the water. The volume of the creek, according to Mr. Winslow's observations at the Rhamkatte Road July 28th, 1886, was 3,610,000 gallons per 24 hours, which is at present more than sufficient for the needs of our city. It is well enough, however, for prudential reasons, and as we are opposed to impounding reservoirs, to bear in mind the fact that as the section of country through which the stream and its tributaries flow becomes more densely populated, highly cultivated and deprived of its forest, the amount of flow diminishes and the danger of contamination increases. At present, however, with the exception of the objections, mentioned above, to Cary and Yates's mill, Walnut Creek, in our opinion, is subject to no more dangers of pollution from storm-water than creeks flowing through any inhabited and partly cultivated country.

At 4:09 o'clock, on Monday afternoon, Octobor 4th, 1886, we gathered specimens of water from the creek, at the Rocky Hole, in the Grimes farm, above the Asylum sewerage, and in about an hour or two afterwards, delivered them, in person, to Dr. C. W. Dabney, Jr. On October 9th, 1886, we received the following analysis from the North Carolina Agricultural Experiment Station, signed by Dr. Chas. W. Dabney, Jr., Director:

N. C. AGRICULTURAL EXPERIMENT STATION,
RALEIGH, Oct. 9th, 1886.

ANALYSIS No. 4151.

The sample of *drinking water* sent to the Station for analysis, in two glass bottles marked ——, water slightly clouded with clay and silica in suspension, contains: Total solids in solution and in suspension, 4.25 grs. per I. gallon. It

was impossible to make quantitative determinations of the different "solids" in the small amount afforded by this sample. Qualitatively examined, the above showed the presence of

Silica, alumina and iron oxides (traces), probably in suspension; *lime*, potash and soda, sulphates and chlorides (traces) in solution; chlorine (1) 0.33, (2) 0.36 grs. per Imperial gallon; free ammonia (1) 0.0266, (2) 0.0266 parts per million; albuminoid ammonia (1) 0.120, (2) 0.110 parts per million.

NOTE.—The only thing about these results which would distinguish this water from the purest spring water, is the very small excess of albuminoid ammonia, unaccompanied by free ammonia in larger amount; and by more chlorine this albuminoid ammonia only points to slight *vegetable contamination*.

Your obedient servant,

CHAS. W. DABNEY, JR.,
Director.

After careful deliberation and much correspondence, we concluded to have our biological work done by Dr. Geo. M. Sternburg, Surgeon U. S. Army, and a most distinguished microscopist. His engagements, however, were such that he was unable, in person, to do the work for us, but highly recommended Dr. A. C. Abbott, Johns Hopkins University, Baltimore, Md., as a man thoroughly competent, having for sometime been his assistant. We therefore engaged Dr. Abbott's services, and in compliance with his directions, at about 4 o'clock on Thursday afternoon, October 21st, 1886, bottled and packed samples of water also taken from Rocky Hole. We sent them to Baltimore by the first express, which was next morning. On Friday night, October 29th, 1886, we received the following report from him:

BALTIMORE, October 28, 1886.

The sample of water sent me by you for biological analysis turns out to be of about the same degree of freedom from bacterial life as that of the city of Baltimore. That is, it is somewhat above the average purity. The plan of investigation that has been pursued is the gelatine plate method of Koch, by which one is enabled to say to a certainty the number of living organisms that may be present in a given volume of water.

In each of the bottles there were small particles of foreign matter held in suspension, which, upon microscopic examination, proved themselves to be nothing of any interest—dirt, vegetable fibre, &c.

The experiments for the detection of the presence of bacteria were conducted as follows:

From each bottle two series of three plates each were made, three of them being made with agar agar (Japanese gelatine) and kept at the body temperature, and three upon table gelatine (flesh peptone gelatine) and kept at the same temperature. Of those on the agar agar and kept at 36° C., the following number of colonies presented after 24 hours:

FROM BOTTLE NO. 1.

Plate made with 1 C. C. of water showed 61 colonies.
Plate made with 0.5 C. C. of water showed 33 colonies.
Plate made with 0.1 C. C. of water showed 5 colonies.

FROM BOTTLE NO. 2.

Plate made with 1 C. C. of water showed 59 colonies.
Plate made with 0.5 C. C. of water showed 35 colonies.
Plate made with 0.1 C. C. of water showed 8 colonies.

In a similar series of experiments made upon gelatine and kept at 21° C. we got the following results after 48 hours:

FROM BOTTLE NO. 1.

Plate made with 1 C. C. of water showed 83 colonies.
Plate made with 0.5 C. C. of water showed 55 colonies.
Plate made with 0.1 C. C. of water showed 30 colonies.

FROM BOTTLE NO. 2.

Plate made with 1 C. C. of water showed 118 colonies.
Plate made with 0.5 C. C. of water showed 79 colonies.
Plate made with 0.1 C. C. of water showed 17 colonies.

Of these numbers 26 colonies of those on the 1 C. C. plate from Bottle No. 1 and 27 colonies on the corresponding plate from Bottle No. 2 caused liquefaction of the gelatine. Of the whole of those present there appeared none that could be considered suspicious, as the whole number comprised, with a very few exceptions, those organisms that make water their common habitat and which possess no known pathogenic properties.

These figures indicate, therefore, the degree of purity of the samples of your water from a bacteriological standpoint.

The number of colonies indicate the number of single organisms that were present at the time the experiment was made, and these colonies are the outgrowth each of a single organism. Water samples differ very widely in the number of contained organisms, some revealing the presence of only one or two per cubic centimetre, while others will be so rich in them as to require a high degree of dilution before it becomes possible to count them at all.

So that from this you will see that the samples of water, as they came into my hands, represent a more than average degree of purity.

I enclose a scheme of the above results made in a condensed form with an average of two bottles.

Very respectfully, yours,

A. C. ABBOTT, M. D.,
Johns Hopkins University, Baltimore.

CONDENSED SCHEME. Water from Walnut Creek.	Amount employed.	Number of colonies on agar agar after 24 hours at 36° C.	Number of colonies on gelatine after 48 hours at 21° C.	Colonies that liquefy the gelatine.	Average number of colonies in the amounts taken.
Bottle No. 1.	1 C. C.	61	83	26	72
	0.5 C. C.	33	55		44
	0.1 C. C.	5	30		17.5
Bottle No. 2.	1 C. C.	59	118	27	88.5
	0.5 C. C.	35	79		57
	0.1 C. C.	8	17		12.5
Average of both bottles	1 C. C.				80
	0.5 C. C.				50.5
	0.1 C. C.				15

To what result, then, does all this lead us, both scientifically and practically? We would state that in our judgment it would be impossible to express a positive scientific opinion upon the purity of any water, unless the investigations extended over a period of at least a year, including chemical and microscopical analyses of several specimens of the proposed water, taken at different times and from different portions of the stream and its tributaries. Neither the time nor the means being allowed us for such investigations, it is manifestly unscientific to express an unconditional opinion for or against the purity of Walnut Creek water, such opinion being based solely upon a single chemical and biological examination, unless, however, such analysis should show very gross pollution. By reference to the above chemical analysis, it will be observed that there is mention of some slight vegetable contamination. The process employed in the chemical analysis being that of Wanklyn, according to his classification such contamination would class it amongst the suspicious waters. By

reference, however, to the reports of the National Board of Health, it will also be observed that although waters contain much larger amounts of albuminoid ammonia, and even free ammonia and chlorine, than the water we have under consideration, yet they are classed as good and organically safe from a chemical standpoint by most competent observers who have used Wanklyn's method. The rigid standard of classification of Wanklyn, therefore, is not unreservedly accepted, but is subjected to considerable variations. The chemical analysis, then, showing the amount of solids, free ammonia and chlorine to be small, according to the standard of all observers, and the quantity of albuminoid ammonia to be within the limits of safety recognized by most chemists, and the biological analysis showing it to be above the average degree of purity, containing not even any suspicious particles in suspension, nor any suspicious organisms, we think that—keeping in view all the while the basis above given for our opinion—the city could accept Walnut Creek water as a safe water,

Provided, 1st. There are no impounding reservoirs upon the stream or upon any of its tributaries, so that the water supply may be taken from the daily flow of the stream.

Provided, 2d. That such an arrangement be made as to prevent as far as possible the pumping into the mains of storm water, even if filtered.

Provided, 3d. That the water be so thoroughly filtered as to remove any excess of albuminoid ammonia, and if any chemical method be employed that not more than one grain to the gallon of the substance used be permitted to pass into the filtered water.

Provided, 4th. That none but filtered water taken from above the Asylum sewer be allowed under any circumstances to be pumped into the mains.

Provided, 5th. That the sources of pollution in the village of Cary and the dam at Yates's mill be removed.

Provided, 6th. That there should be a constant service under high pressure.

In conclusion, we advise that legislation be obtained from the next General Assembly empowering the city authorities to police the water-shed.

Respectfully submitted,
JAMES McKEE, M. D., CHAIRMAN,
RICHARD H. LEWIS, M. D.,
W. I. ROYSTER, M. D.,
HUBERT HAYWOOD, M. D., SECRETARY,
Special Committee Wake County Board of Health.

Received, unanimously adopted and ordered to be transmitted by the County Board of Health, through this special committee, to the Water Works Committee of the Board of Aldermen.

This was done November 2d, 1886.

APPENDIX.

THE CARE OF

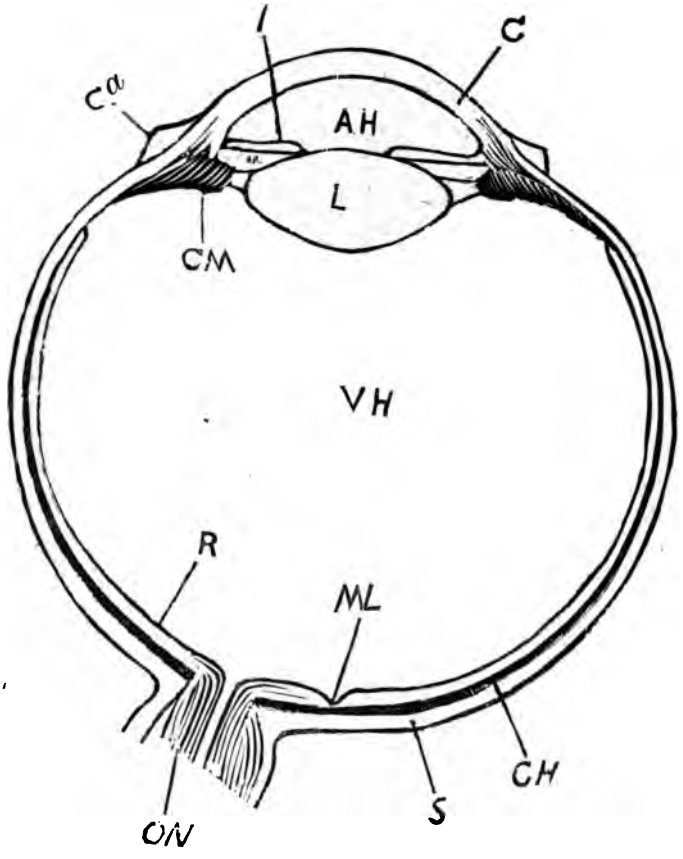
THE EYES AND EARS.

BY

RICHARD H. LEWIS, M. D.,

MEMBER OF THE STATE BOARD OF HEALTH, AND SURGEON FOR DISEASES OF THE EYE, EAR AND THROAT TO ST. JOHN'S HOSPITAL, AND TO THAT OF THE LEONARD MEDICAL SCHOOL, RALEIGH, N. C.

DIAGRAM OF THE EYE IN HORIZONTAL SECTION.



S, sclerotic coat; CH, choroid coat; R, retina, or nervous coat, continuous with ON, the optic nerve; ML, Macula lutea, or yellow spot, the centre of retina; VH, vitreous humor; L, lens; AH, acqueous humor; I, iris; CM, ciliary muscle; C, cornea; Ca, conjunctiva.

PREFACE.

THE object of this article, prepared at the request of the State Board of Health, is to assist, as far as may be, in preserving in a condition of health and usefulness the most important of the senses.

Eyesight stands easily first in the estimation of all, and Hearing is only second to it. Blindness being one of the most frequent causes of pauperism, it becomes still more the duty of the guardians of the public health to present to the people such information as may help to prevent its occurrence than a regard simply for the happiness and prosperity of the individual would require. But there are so many instances of damage to, and loss of, one or the other of these precious senses when they might have been saved by the knowledge of a few simple facts, that there is no need to mention the relief of the community of a pecuniary burden to show the necessity for such a publication.

This, then, being intended for those not at all versed in medicine, must be as free as possible from the technicalities in which the professional man is accustomed to think, and at the same time as brief as possible in order to come, together with other necessary publications, within the resources of the Board for printing. The difficulties of the task are greatly increased by these conditions, but it shall be my endeavor to be as plain and simple as possible, and at the same time as concise as a regard for clearness will permit. I trust the kind reader will bear these facts in mind.

217 N. WILMINGTON ST.,
Raleigh, N. C., May 12, 1886.

THE CARE OF THE EYES.

In order to understand and appreciate instructions as to the proper method of caring for any organ, it is absolutely necessary to have some idea of the nature of that organ. We must therefore, before going farther, study for a few minutes the structure of the eye. Reference to the diagram in front will assist greatly in understanding what follows.

The eye is a nearly round ball about seven-eighths of an inch in diameter. The walls of the posterior five-sixths of this globe are made up of three thin coats, lying one immediately upon the other like the layers of an onion. The interior of this part is filled with a rather thick, viscid, but perfectly transparent fluid called the vitreous humor. The outermost of these three coats or layers is a dense opaque membrane named the *sclerotic*, fibrous in structure, something like the tendons or "leaders," and therefore very strong and tough. Its purpose is to preserve the shape of the ball and to protect the more delicate structures within. This constitutes "the white of the eye." Next to that is the middle coat, or *choroid*, which is composed of a network of blood-vessels, in the meshes of which is deposited a kind of dark pigment or coloring-matter, the object of which is to prevent dazzling from bright light. The eyes of albinos are very sensitive to light, owing to the absence of this coloring-matter in this coat as well as in the hair. At its front border this coat is thickened by the addition of another element, the ciliary muscle, or muscle of accommodation—a structure of great interest and importance to us. Interior to this is the third and innermost layer, called the *retina*. It may for our purposes be considered an expansion of the optic nerve, which, coming from the brain, perforates the first two coats and then spreads out into this nervous layer, "like the cup of a tulip on its stem." This is the sensitive plate on which the pictures of all objects seen are taken.

The front of the eyeball is quite different from that portion we have been considering. The first thing we notice is a perfectly transparent structure (the remaining one-sixth of the whole ball), which appears to be part of a smaller globe, and which seems to be set in the white of the eye like a watch-crystal in its rim. This is the *cornea.* Just back of that we observe a very beautiful curtain, which, on account of its infinite variety of colors in different individuals, is called the *iris*—that word meaning a rainbow. Near the centre of this curtain is a round black spot, which is often referred to in common language as "the sight of the eye." This is merely a window or opening in the curtain, the *pupil,* through which light enters the eye, and out of which we see. This window partially opens and shuts automatically in order to regulate the amount of light. The space between the iris and the transparent cornea is filled with a watery fluid, the *aqueous humor.* Immediately behind the iris, suspended in a little sac, is the *crystalline lens.* It is convex or bulging, both in front and behind, and its function is to make pictures on the retina of all objects before the eye.

Covering all of the white of the eye that can be seen, and leaping from that over to the lids and lining their under surfaces, becoming continuous with the skin at their edges, is an exceedingly thin, transparent mucous membrane called the *conjunctiva.* It is this membrane which is involved in ordinary simple inflammations of the eye. It is lubricated by tears manufactured for the purpose by the lachrymal gland at the upper and outer corner, the surplus being carried off by two little gutters in the inner ends of the two lids which open into a larger drain emptying into the nose. Each eye is moved in different directions by six little muscles, but the only ones of special interest to us are the two inner straight muscles, that are attached one to the outside of each eye next the nose, which converge the two eyes upon near objects.

For the sake of clearness we will make two general divisions of our subject, and consider the eye first in its relation to weak sight; and secondly in its relation to blindness, although they will overlap one another at certain points.

WEAK SIGHT.

Weak sight is that condition of affairs in which, while there is no evidence of disease, the eyes are nevertheless unequal to the performance of their legitimate work. The acuteness of sight for ordinary distant objects is sometimes below the standard and sometimes not, but, whether it be or not, any continuous effort at *near* work, as reading, writing, sewing, etc., is impossible, and always brings on a certain characteristic group of symptoms. First, a heavy, tired feeling in and around the eyes is observed, and then the letters or stitches become indistinct. After a rest of a minute or two, they can be again seen plainly, only to become blurred even more and in a shorter time than before. A repetition of these attempts causes pain and watering of the eyes, with redness of the balls and edges of the lids, often headache, and, in some cases, a disturbance of the general health, more especially the nervous functions. If attended to promptly, it can nearly always be easily relieved; but if it be neglected and nothing done for it, perseverance in near work is liable to cause such sensitiveness and irritability of the eyes as to render them not only practically useless, but a constant source of annoyance and discomfort in the ordinary lights we must daily encounter. It is exceedingly common (and through heredity becoming more so every day), and, while not productive of blindness, interferes seriously with the practical use of the eyes, as we have just said. It is, moreover, very often met with in the young during school-life, when it prevents their studying with ease and comfort, if they can at all, and by so doing obstructs the formation of the *habit* of study, which in the average boy demands every encouragement, thereby affecting injuriously the character, probably for life. Such being the case, and the remedy for these troubles being very simple and easily applied when once they are recognized and their true nature appreciated, the Board of Health regards it as of prime importance that the public should be put in a position to recognize and appreciate them.

Advice to intelligent people is much more apt to be taken, if accompanied by the reasons for it, and they are, besides, much more likely to be interested in a subject if it can be explained and made clear, than they would be in a mere didactic statement of bald, unillustrated facts. Therefore, as interest in these important matters, on the part of the people, is what the Board is especially anxious to create, I shall endeavor to elucidate the subject in as simple a manner as possible.

Weak sight—asthenopia, as it is technically called—is sometimes due to a weak and irritable condition of the nervous apparatus of the eye, pure and simple; and this form occurs most frequently in young women, who are peculiarly prone to functional nervous disturbances. But in a vast majority of instances, it is caused by an *overstrain of the muscles* of the eye, either those which adjust each eye for objects at different distances, or those which turn both eyes in upon near objects. This overstrain may be, and sometimes is, due to simple weakness of these muscles, as often occurs during convalescence from severe attacks of illness, in which cases it is only temporary; but it is nearly always a consequence of the faulty shape of the ball, causing certain optical defects or errors in refraction, as they are usually called.

In order to understand these optical defects, it is necessary to first understand what is a correct eye, and how we see with it. The knowledge of a few facts in regard to the nature of a convex lens will render this easy.

A convex lens is a body of some transparent material, usually glass as we see it, flattened from side to side, thicker in the middle than at the edges, with its faces having the curvature of part of a sphere or round ball. A familiar example is an ordinary magnifying or sunglass. Its peculiar property is that rays of light emanating from any object, after passing through it, are brought together again in the same relation to one another as they started from the object, and a picture or image of it is thereby produced. The point at which this union is effected, is called the *focus* of the lens. The *more convex* the lens, the stronger it is and the *shorter* is its focus. The action of a convex lens can be

interestingly illustrated in this way: Having closed all the doors and windows of the room except one, in order to shut off the side lights, take a magnifying-glass—or, if not convenient, the spectacles of the oldest person in the house, they being convex lenses—and holding it immediately opposite the window, about three feet from the wall, gradually approach it thereto, and you will presently see come out on the wall a distinct picture, turned upside down, of the sky, trees and other objects outside.

If you will turn to the diagram of the eye, you will recall that the lens is situated immediately behind the iris and opposite the pupil, and that the sensitive retina is the coat nearest to it, being the innermost of the three. Now, as the convex lens of glass held opposite the window of the darkened room makes a picture of outside objects on the wall, just so does the convex lens in the dark chamber of the eye placed opposite the only window, the pupil, make a picture of outside objects on the retina, which in the normal eye is exactly at its focus. The impression thus made upon the retina is transmitted to the brain by the optic nerve, and the act of vision is complete.

In what has been said about rays of light, reference has been had only to rays from *distant* objects, which are always practically parallel to one another. It is an optical fact that rays emanating from objects nearer than twenty feet sensibly diverge from one another, and that the nearer the object the more divergent they are. A lens having only so much power to concentrate light, it is evident that divergent rays cannot be brought to a focus as soon as parallel; in other words, that their focus must be farther from the lens. This being true, how is it that we see near objects distinctly, as the retina cannot be set back to this new focus? By an increase in the thickness or convexity of the lens, which, as you remember, *shortens* the focus. This is what is called the accommodation of the eye, and it is effected in the following manner: The inherent tendency of the lens-substance, which is exceedingly elastic, is to assume a more globular form, but, enclosed in a sac, it is suspended or swung in the larger concentric circle made by the ciliary muscle by means of a connect-

ing band (see diagram), and as long as the muscle is at rest the sac is kept upon the stretch and the lens more or less flattened. As soon, however, as the muscle contracts, being a ring, it must become smaller, and in so doing necessarily slacks the sac, thereby allowing the lens to follow its natural bent and bulge more in the middle. This is clearly shown in Fig. 1, where one-half

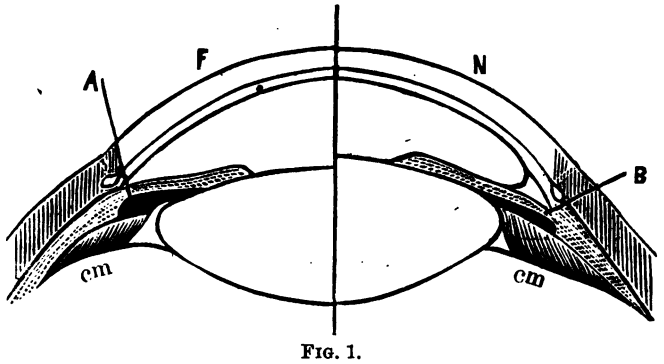


FIG. 1.

represents the position of the parts when the eye is at rest or adjusted for distance, and the other half when the muscle has contracted and it is adjusted for near objects. It will be observed that the edge of the lens is nearer to the muscle in the latter, and that therefore the suspensory ligament or band must be slacked.

In this way each separate eye is accommodated for different distances, but, as we always use the two eyes together, the adjustment is not complete unless they are both fixed upon the object. This convergence is made by the inner straight muscles attached to the sides of the balls next the nose, and the nearer the object of course the more must the eyes be turned in.

Thus we see that the adjustment of the eyes for near objects is accomplished by a *muscular effort* on the part of two sets of muscles, and that the *nearer* the object the *greater* the effort required of both, so that there is always a harmony of action between the two. If you will look steadily at a pencil or your finger held less than six inches from the eyes, you will be distinctly conscious of this effort, which if kept up becomes painful;

but at the ordinary distance of ten or twelve inches it is not perceptible in eyes of the proper shape. But variations from this proper shape are exceedingly frequent, and, as said before, defects in form are nearly always at the bottom of weak sight. They are of three kinds. In Fig. 2 the line **X Y** represents the retina in a normal eye at the proper distance from the lens, but

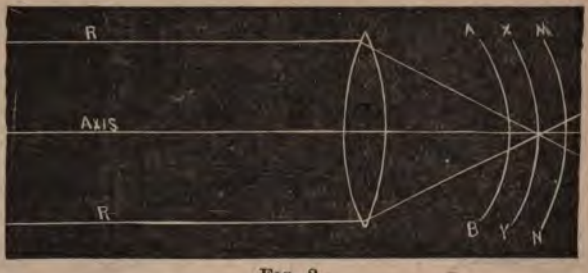


FIG. 2.

the eye may be too short, with the retina too close to the lens, **A B**, causing *over-sight* or *far-sight;* or it may be too long, with the retina too far from the lens, **M N**, causing *near-sight* or *myopia;* or the clear front, the cornea, may be irregular in its curvature, producing what, for want of a common name, will have to be called by the technical term of *astigmatism.* An easy way to remember these errors is to bear in mind that the short eye has long sight, and the long eye short sight, while the astigmatic eye does not have good sight at any distance.

Over-sight or *Far-sight* is by long odds the most common of these optical defects, certainly in this country, and it is therefore the most frequent cause of weak sight. But how does it cause weak sight? you will ask. By adding to the strain upon the accommodation. In the normal eye, the retina being exactly at the focus of parallel rays (**X Y**, Fig. 2), no effort whatever is required for distant vision, and the accommodation for near objects can be made without trouble; but in the short eye (**A B**) the focus must be shortened even for distance, and consequently just that much work must be added to what is usually required of the little muscle; and that is too much for it, so it breaks

down, and we have precisely what we would expect from muscular fatigue—viz., the sense of weariness and heaviness about the eyes, the recurring dimness of the letters, the aching, and other symptoms characteristic of weak sight. Therefore, upon the occurrence of these symptoms we would suspect the presence of over-sight, especially if distant vision were perfect (which would exclude near-sight and astigmatism), although it is not perfect in the highest degrees of over-sight itself, because in them the ball is so very short that it is beyond the power of the muscle to bring up the focus of even parallel rays to the retina. Such cases, however, are comparatively rare. Another effect of this over-sight is that the harmony of action between the two sets of muscles used in adjusting the eyes, accommodation and convergence, is destroyed, and as a result we frequently have crossed eyes, this being the cause in over 75 per cent. of such cases.

The remedy is simple and—if applied early before the eyes become chronically irritable—sure. Everything necessary to be done is to shorten the focus of the lens in proportion to the shortness of the eye, so as to do away with all extra effort—that is, all effort for distance—and put the eye on an equality with the normal eye. This is easily done by adding on another convex lens of the proper strength in the shape of spectacles.

Near-sight or *Myopia* is a subject of peculiar interest to the custodians of the public health. It is just the opposite, optically, of far-sight or over-sight, and, while the conditions causing the latter are always congenital, in near-sight they originate, as a large number of investigations show conclusively, between the ages of six and sixteen, or during school-life—rarely before and rarely after that period.* Heredity exerts a powerful influence

* It appears from the German statistics that the percentage of myopia, beginning with less than one half of 1 per cent. during the first half year of school-life, increased gradually from year to year to over 60 per cent. on an average in the highest class, in one instance going as high as 79 per cent. The Germans, however, are a peculiarly near-sighted race, and in this country the percentage of short-sight is only about half as great. An interesting result of the American observations is the fact that myopia is very rare among the negroes; all of which demonstrates in a general way the influence of literary culture and of heredity in the causation of this trouble. The investigations further show that the devel-

in its production, a considerable proportion of the children of one near-sighted parent being apt to develop it, but it is very often acquired when there is no predisposition to it. When once established it is incurable. *It can to a large extent be prevented by proper care* on the part of parents and teachers during the period named. I shall therefore, as the representative of the Board of Health in this matter, endeavor to set forth clearly the true character of the affection, with the means of its prevention, in order to save our people as far as possible from becoming any more "bespectacled" than is absolutely necessary.

As mentioned above, near-sight is due to an elongation of the eye-ball displacing the retina backward, so that parallel rays come to a focus in front of it, and only divergent rays—from near objects—come to a focus exactly on it, and they only, therefore, can be distinctly seen; so that the causes of short-sight are to be found in everything that has a tendency to increase the length of the ball.

Merely mentioning the fact that anything injurious to the general health, by weakening the resisting power of the tissues of the eye in common with those of the rest of the body, assists in producing this elongation, and calling attention especially to the execrable ventilation of many school-rooms as a most active agency in this category, I will point you particularly to those causes acting directly through the eye itself.

It is now regarded as an established fact that the continued tension of the muscles of adjustment (accommodation and convergence) is the principal factor in the production of near-sight; and, it having been explained above that the nearer the object to the eyes the greater the tension or strain upon both these sets of muscles, it follows that everything having a tendency to cause the undue approximation of objects on which the eyes are continuously used during childhood assists in the origination of this condition. I say "in childhood," because, as we have seen, it nearly always begins during that period; and it does so for the

opment of near-sightedness is in a direct ratio to the prevalence of the unfavorable conditions referred to in the text, and that it increases in degree, after it has once started, from year to year.

reason that the tissues of all growing and immature animals are more soft and yielding than when they have attained the firmness of maturity—another reason for special attention to their general health at this time.

Since a large part of childhood, and particularly that part of it in which the eyes are used most on near objects, is passed in the school-room, it is there that we would naturally seek the causes of this trouble. And it is there that they are generally found. School-children are often compelled to hold their books too near—that is, nearer than ten inches—because the amount of light is insufficient. This question of plenty of light of good quality (the best is direct from a northern sky) in the school-room is of the highest importance, and cannot be impressed too deeply upon those having such matters in charge. In a general way, it may be said that there should always be enough light to enable a child to read on a moderately clear day fine print in the darkest corner of the room at the distance of a foot. And the direction from which it comes is also important. Preferably it should come from the left and above, so that, while illuminating the page, it may not fall upon the eye, nor cast a shadow of the hand in writing. The next best direction is from behind, then from the right, but never from in front. The children should always look at a dead wall. I append an admirable statement of the "Requirements of the Model School-room,"* copied in

* "REQUIREMENTS OF THE MODEL SCHOOL-ROOM.

"(1) *Shape.*—It should be oblong, the width being to the length about as three to four, with the teacher's platform at one end.

"(2) *Size.*—For primary or grammar school, with register of 54 pupils and attendance of about 50, the room should be about 33 feet long, 25 wide, and 13 high, which gives practically upward of 200 cubic feet of air and 16½ square feet of floor-space to each pupil.

"(3) *Lighting.*—Four windows on the left of the pupils as they sit, the tops being square and not more than six inches from the ceiling, the bottoms being at least three and a half feet from the floor, equally spaced, not grouped, with transom sashes hung at the base above the sliding sashes. A window or two in addition at the back is admissible. The size of the windows on the side, taken collectively, should equal at least one-sixth of the floor-space. The highest authorities in school hygiene require 300 or 350 square inches of glass for each pupil.

the *Sanitarian* for October, 1885, from *City School Systems of the United States*, and earnestly commend it to all school boards and others having in charge the building of school-houses. It need not be more expensive than the ordinary plan, except in the matter of windows; and I am sure no one will grudge the children under his care in this respect the very slight additional cost necessary to supply them with light enough for the comfortable and *safe* use of their eyes.

The light being sufficient, the print may be bad or too small, though this danger has now been largely eliminated by the spread of knowledge on this subject and the active competition of publishers.

Sometimes the proportion between the height of the seat and that of the desk is such as to bring the book too near, as a low seat with a high desk.

Occasionally the seat has no back, so that from sheer fatigue the child is constrained to lean forward on the desk to rest himself.

Any of these things may cause this dangerous approximation, and not infrequently it is made more hurtful by a system of instruction which requires it to be kept up continuously for hours at a time.

"(4) On the side opposite the windows two doors, with transom windows above hung at the base, and between these transom windows, and on the same line, two more windows of the same kind and hung in the same manner.

"(5) The wall should be slightly tinted, but not the ceiling.

"(6) A black-board may be between the doors, but a sliding black-board back of the teacher's platform, or a portable one on the platform, in accordance with the German idea, would perhaps be better than the profusion of wall black-board now in vogue among us.

"(7) *Location of Seats.*—The main rule to be observed in the placing of the seats is to carry them as far as possible toward the window side of the room, and as far as possible from the opposite side; the aim being to make the arrangement such that the distance of the outer row of desks from the windows shall not exceed once and a half the height of the top window from the floor."

Proper height of seats and desks for different ages, as approved by the Boards of Health of New York and Chicago:

From	7	to	9	years,	top of desk	23	inches,	front of seat	12¼	inches.
"	9	to	11	"	"	24	"	"	12¾	"
"	12	to	14	"	"	25¾	"	"	14	"
"	15	to	18	"	"	27½	"	"	16¼	"

The approximation of the book to too near a point is dangerous, because, as we have seen, it necessitates a strain upon the muscles of adjustment. That strain excites an increased flow of blood to the eyes to furnish the power for the extra work. The increased amount of blood causes dilatation of the blood-vessels and congestion, which conduces to the softening and degeneration of the coats, especially of the outer, tough, white coat, whose peculiar function is to preserve the shape of the ball. At the same time it has a tendency to augment the volume of the humors within the eye. This increase in the humors adds to the pressure from within outward, causing the softened coats to give way or bulge slightly at their weakest point, which is at the back, around the entrance of the optic nerve. But the principal factor, probably, in the production of the bulging is the squeezing of the ball by the muscles which move it, as they are put greatly upon the stretch when the eyes are turned in much. The walls, having once begun to give way, become thinner and less able to resist, and, the same causes continuing to act, the near-sight is apt to increase. If the bulging extend beyond a certain point, the two inner and more delicate coats become very much damaged, and sometimes destroyed, by the excessive stretching. Occasionally the retina, unable to follow farther, is detached from the coat lying under it, and then total destruction of sight is only a matter of time. So that short-sight is nearly always accompanied by a *diseased condition*, often progressive in character, that may, and not infrequently does, end in blindness, making our duty to give warning of its dangers the more imperative.

It is the duty of the teacher to see to it that the faulty conditions as to light, etc., above indicated, are corrected, so far as lies in his power. He should, besides, make it a point to frequently interrupt the studies by various appropriate exercises (now common in well-managed schools) which will permit a rest of the eyes, and by frequent recesses. Parents also should exercise supervision in these matters at home, and in addition to carrying out the instructions given under the head of "General Directions," they should forbid too much study and reading, especially

if their children be precocious and disposed to be bookish, and encourage them to outdoor life. This is often the more urgent because such children are apt to be feeble and delicate in constitution.

Owing to the presence of disease in so many near-sighted eyes, they are very often sensitive, irritable and painful. The ordinary symptoms of weak sight, too, are frequently complained of, even when the morbid changes are not very marked, they being due to the overstrain of the muscles of convergence, caused by the necessity of holding the book too near in order to make out the letters.

Attention to the presence of this defect will most likely be called by the child's inability to read figures on the black-board, or in some similar way. Either a *high* degree of over-sight or the irregular error, astigmatism, may cause this as well as short-sight, but the difference between them and the true myopia is that in the last the sight for objects held near enough is generally unusually acute, while in the first two it is apt to be more or less proportionally bad at all distances.

When once the fact becomes known, the eyes should be scrupulously guarded, and upon any complaint (or without waiting for it if the child seems to be very near-sighted) the advice of a competent physician should be promptly sought, so that he may give fully and explicitly the proper directions for the treatment and care of the eyes, including, if the state of the case warrant them, the proper concave glasses. Concave glasses, being the reverse of convex, lengthen the focus to suit the (short-sighted) long eye. It is of peculiar importance that accurately-adjusted glasses should be worn in these cases, because they not only permit the removal of the book to a safe distance, thereby assisting greatly in checking the progress of the affection, but they also enable the child to imbibe unconsciously a vast amount of knowledge that would otherwise escape him. At the same time, being in a position to see and enjoy the world around him, he would be encouraged to use them on distant objects and get away from his books.

Astigmatism.—The explanation of this error is apt to be so confusing to any one not quite familiar with optics that I shall not weary you, but will merely mention certain characteristic facts. The astigmatic person sees neither distant nor near objects distinctly, but he has the peculiarity of seeing lines running in one direction more clearly than others at right angles to them, and these lines are usually vertical and horizontal. He is apt to complain of all the symptoms of weak sight, probably in an exaggerated form, with an unusual amount of headache, and sometimes other nervous symptoms. Glasses accurately calculated, and made (as they must be) for the particular individual, render the sight acute, and are often of unspeakable comfort.

Old Sight cannot be considered, strictly speaking, as an optical defect, but it is merely one of the changes which come to us all with age. The lens of the eye becomes stiff and hard, less elastic than in our younger days, and consequently when the muscle of accommodation, which has also lost some of its vigor, slacks the sac holding it, it does not assume the convexity necessary for distinct vision of near objects. At the same time, distant vision remains as good as ever, because, as you remember, no adjustment is needed in the normal eye for distance. It usually makes its appearance between forty and fifty years of age. The first symptom is a disposition to hold the book or paper rather farther off or to seek a better light, especially at night. After a little the symptoms of weak sight come on, and for the same reason that they usually appear, viz., overstrain of the muscle, though this time it is not due to the shape of the ball, but the consistence of the lens. The remedy is found in convex glasses, which by shortening the focus assist the accommodation and relieve the strain. It is very important to put on glasses as soon as needed, to avoid this strain, not only as a matter of comfort, but because the overstraining of old eyes is thought to be one of the causes of a most serious and fatal disease of the eye.

RECAPITULATION.

In the preceding pages an attempt has been made to set forth, as simply and clearly as possible, certain facts of general interest

and importance in regard to the eye, especially those bearing upon the exceedingly common and troublesome group of symptoms included under the general term, "weak sight," and upon the nature and dangers of near-sight. The subject has been dwelt upon—to the point of tediousness, some will feel, I fear—because, while of very frequent occurrence, and when present very annoying, even to the extent of rendering the eyes practically useless, the nature of weak sight is not at all understood by most people, nor are they aware that it can in most cases be completely relieved by a very simple remedy. Neither is it generally known that near-sight, often the result of preventable causes, is frequently associated with disease that may prove fatal to vision, and that special care is therefore required in its management. On the contrary, the popular opinion is that near-sighted eyes are strong eyes.

It has been shown that in the normal eye objects are seen by the formation of images or pictures of them through the instrumentality of the lens on the sensitive retina; that distant objects are seen clearly without effort, while near objects are made distinct, by a muscular effort, it is true—the accommodation—but one that can be made and kept up without fatigue; and that the two eyes are held upon near objects comfortably by the muscles of convergence. It has also been explained how certain departures from the normal in the shape of the eyeball will bring about an overstrain of one or both of these sets of muscles, causing weak sight. Attention was called to the short eye, causing over-sight or long-sight, as by odds the most frequent cause of weak sight, though certain nervous conditions, weakness of the muscles from sickness, and strain of the muscles of convergence in short-sight, were mentioned as being sometimes responsible for it. It has been further made plain that near-sight, or myopia, is the result of an elongation backward of the globe; that it nearly always originates during school-life or between the ages of six and sixteen; that it is often progressive in character, and is then associated with diseased conditions which may lead to total loss of sight; that its cause is too great tension or strain of the mus-

cles of adjustment, resulting from too much study or from unfavorable surroundings, necessitating an overstrain by requiring too near an approximation of the object; and, finally, that it is largely preventable by proper care.

GENERAL DIRECTIONS.

The directions for the proper use of the eyes follow, almost as a matter of course, from what has been said.

Always have plenty of light. Economy in light is very poor economy. Many of the most intractable forms of weak sight I have seen have resulted from the use of the eyes by a bad and insufficient light. Any good, white, steady light will answer, provided it is *bright* enough. The German student's lamp, looked at from every point of view, expense included, is probably the best light, but any good lamp, with a large wick, that is kept clean and well-trimmed and filled with good oil, will do very well. Avoid flickering gas-jets. If you prefer gas, see that the flame is steadied by an argand burner or a transparent globe with a large opening below. The light should come from behind and the left, so as to illuminate the page and not the eyes. Nothing is more irritating than a number of lights falling upon the eyes from different directions, as the jets in a church or public hall, and those with sensitive eyes should never attend such places at night without the protection either of dark glasses or a shade.

Never read by twilight. I have in mind now, a young lady of prominence, who, for one imprudence in this respect, forfeited the use of her eyes for months, not to mention the positive suffering she endured.

Do not read lying down. Owing to the position, the eyes are more than usually full of blood, and the muscles are unduly strained because of the practical impossibility of holding the book squarely before the eyes. For a similar reason, do not employ the eyes in a stooping position; it obstructs the return flow of blood from the head and eyes. "Carry the book to your eyes, and not your eyes to the book."

Eschew the pleasures of book or newspaper while riding, unless the vehicle be very steady. The work of adjustment is greatly increased by the shaking of the letters; the eye has "to take them on the fly," as it were, and it is very fatiguing. It should never be done, even on the smoothest railway, if the eyes are not perfectly strong.

Never sew on black at night. Black absorbs so much light that no ordinary artificial source can afford enough for its proper illumination.

Whenever the eyes become tired and uncomfortable stop work and rest them awhile. If you persist in using them after the warning, you will be apt to suffer for it. If the fatigue and discomfort be so marked as to amount to weak sight, seek advice from some competent physician, who will nearly always put you in the way of obtaining permanent relief.

If old enough to wear specs, put them on as soon as you feel the need of them; which is to say, when you catch yourself holding your book farther off in the day and abusing the lamp and the print at night.

Plenty of sleep is important. When the eyes are weak, it is a necessity. Should you have children, observe them while using their eyes, and if they hold the book too near or if they complain of them, examine into the matter carefully. By following the directions given at the end of this discourse, you can form some idea of the trouble yourself, though only the skilled physician can relieve it. Being ambitious and studious, do not urge them to still greater tasks for the gratification of your own pride and run the risk of irreparably damaging their eyes or ruining their health for life; but judiciously curb their enthusiasm, impressing upon them the important truth that the sound body is as necessary as the cultivated mind. I have been shocked at the folly sometimes exhibited by parents in this respect.

GLASSES.

Glasses for the young, owing to the peculiar character or the serious nature of the defects occurring among them, should

always be selected by some one thoroughly familiar with the subject. Says a well-known writer: "The selection of glasses for short-sight requires great care, as much harm may be done by using those that are too strong or that are not properly fitted to the eye. In many cases the plan of 'trying' the various glasses on the optician's counter—or, far worse, in the peddler's box—is about as rational and safe as it would be, in case of sickness, to *try* the contents of the various bottles on the druggist's shelf without a prescription." But in old sight it is not so serious a matter, and at the end I append a simple rule for the selection of such glasses that may prove a help to some of my readers.

Spectacles are, as a rule, better than eye-glasses, because the lenses are kept in the right position more easily, though the latter are often very handy, especially when the specs become mislaid, as they frequently do when not worn constantly. In such cases, if expense be not an item, it is very convenient to have both. The frames are a matter of taste only, provided they fit the face properly, so as to put the centre of each lens opposite each pupil and the right distance from the eye. Steel frames are most generally worn, but for constant use in summer some non-corrosive material is better, and even gold is more economical in the long run.

All glasses are equally good, provided they are equally homogeneous and transparent, the only difference between them being in the curvature of their surfaces. "Pebbles," while much more costly, have no special virtues over glass, other than greater hardness, and consequent less liability to scratch, and a little less weight in the higher numbers. Quite often they are much inferior to glass, because, being cut from a natural and peculiar product, fluor-spar, they must be made with great care or they are much worse than glass, and that care is not always bestowed on them. Be not deceived by the oily-tongued venders of spectacles travelling through the country. The truth is not in them, and they usually charge from two to ten prices. If you are so unfortunate as to need glasses, and feel equal to selecting them for yourself, buy them from some optician or jeweller in your nearest town whom you *know* to be a man of character.

From $1.50 to $2.50 is ample for the best glasses in good steel frames, and from $5 to $10 in gold, unless the lenses be of the peculiar kind required in astigmatism or a combination of different sorts.

BLINDNESS.

In considering the care of the eyes in its relation to blindness, we must deal with the diseases and injuries to which they are liable. For a thorough exposition of the subject volumes would be required, such has been the progress in this branch of medicine; but of course in a publication of this kind it is only intended to call attention to certain facts in connection with them that ought to be in the possession of everybody, as a general knowledge of them would annually save this most precious of the senses to very many.

Having already, in the first division of our subject, dwelt upon the diseased conditions associated with near-sight which sometimes cause the loss of vision no further allusion will be made to them.

By long odds, the most frequent of the diseases practically interesting to us is an inflammation of the delicate membrane covering the front of the ball and lining the under surfaces of the lids called the *conjunctiva.* There are many varieties of this, but the symptoms common to all of them are redness of the eyes with more or less swelling of the lids and a discharge of mucus or matter. The severity of these symptoms is an index of the gravity of the attack. The discharge is *highly contagious,* and, as the matter from a mild case may excite an attack of dangerous severity in another, the most scrupulous cleanliness should be observed, and no one should be permitted to use the same wash-bowl or towels as the patient.

A familiar illustration of this class of diseases is the common "sore eyes" which goes through the country every few years, and which, it may interest you to know, is technically known as catarrhal conjunctivitis or catarrhal ophthalmia. It is generally of a mild type, with a tendency to recovery, and is, for the most part, treated without the aid of a physician, and usually with

success. But just here I must sound a note of warning against the use of any preparation of *lead*. I mention this, because if the clear "watch crystal" becomes ulcerated, as it sometimes and not very infrequently does in this disease, the lead becomes deposited on the rough surface of the ulcer in the form of its insoluble carbonate, or white paint. It sticks so closely that it cannot be satisfactorily removed without damaging the eye, and is occasionally the cause of its total loss. I have seen a number of such cases. A popular old remedy known as "Thompson's eye-water" is said to be one of these lead preparations, and should never on that account be used, as it cannot be predicted when these ulcerations may occur. Any simple astringent, as alum-water, a teaspoonful to a pint, or borax-water, twice as strong, a few drops in the eyes three or four times a day, or simply bathing the closed eyes for fifteen or twenty minutes at a time several times a day with water as hot as can be borne, will answer; but if the eyes become decidedly painful and sensitive to light, and especially if the transparent part appear smoky or rough, seek your physician immediately, as the eye is in danger and more careful treatment is necessary.

The gravest of this class is the inflammation which comes on during the first week of life, usually in the first three or four days after birth. It is the most frequent cause of hopeless blindness, 30 *per cent.* of the inmates of the blind asylums of Great Britain having lost their sight from it, and in the United States 32 *per cent.* of those blind from preventable disease tracing to it. And the pity is the greater because it is very amenable to proper treatment, and this fearful loss of sight must therefore be largely attributed to either ignorance or neglect. It can be easily recognized by the symptoms common to the class mentioned in the beginning—viz., redness and swelling of the lids, with a *discharge of matter*, occurring shortly after birth. In view of its dangerous and, in bad cases, rapidly destructive character (twenty-four to forty-eight hours sometimes sufficing to compass the loss of the sight), no time should be lost in trying breast-milk, rotten apple, tea-leaves, alum curd, or other infallible remedies of the monthly nurse, but the physician should be called *at once*.

if their children be precocious and disposed to be bookish, and encourage them to outdoor life. This is often the more urgent because such children are apt to be feeble and delicate in constitution.

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Attention to the presence of this defect will most likely be called by the child's inability to read figures on the black-board, or in some similar way. Either a *high* degree of over-sight or the irregular error, astigmatism, may cause this as well as short-sight, but the difference between them and the true myopia is that in the last the sight for objects held near enough is generally unusually acute, while in the first two it is apt to be more or less proportionally bad at all distances.

When once the fact becomes known, the eyes should be scrupulously guarded, and upon any complaint (or without waiting for it if the child seems to be very near-sighted) the advice of a competent physician should be promptly sought, so that he may give fully and explicitly the proper directions for the treatment and care of the eyes, including, if the state of the case warrant them, the proper concave glasses. Concave glasses, being the reverse of convex, lengthen the focus to suit the (short-sighted) long eye. It is of peculiar importance that accurately-adjusted glasses should be worn in these cases, because they not only permit the removal of the book to a safe distance, thereby assisting greatly in checking the progress of the affection, but they also enable the child to imbibe unconsciously a vast amount of knowledge that would otherwise escape him. At the same time, being in a position to see and enjoy the world around him, he would be encouraged to use them on distant objects and get away from his books.

Astigmatism.—The explanation of this error is apt to be so confusing to any one not quite familiar with optics that I shall not weary you, but will merely mention certain characteristic facts. The astigmatic person sees neither distant nor near objects distinctly, but he has the peculiarity of seeing lines running in one direction more clearly than others at right angles to them, and these lines are usually vertical and horizontal. He is apt to complain of all the symptoms of weak sight, probably in an exaggerated form, with an unusual amount of headache, and sometimes other nervous symptoms. Glasses accurately calculated, and made (as they must be) for the particular individual, render the sight acute, and are often of unspeakable comfort.

Old Sight cannot be considered, strictly speaking, as an optical defect, but it is merely one of the changes which come to us all with age. The lens of the eye becomes stiff and hard, less elastic than in our younger days, and consequently when the muscle of accommodation, which has also lost some of its vigor, slacks the sac holding it, it does not assume the convexity necessary for distinct vision of near objects. At the same time, distant vision remains as good as ever, because, as you remember, no adjustment is needed in the normal eye for distance. It usually makes its appearance between forty and fifty years of age. The first symptom is a disposition to hold the book or paper rather farther off or to seek a better light, especially at night. After a little the symptoms of weak sight come on, and for the same reason that they usually appear, viz., overstrain of the muscle, though this time it is not due to the shape of the ball, but the consistence of the lens. The remedy is found in convex glasses, which by shortening the focus assist the accommodation and relieve the strain. It is very important to put on glasses as soon as needed, to avoid this strain, not only as a matter of comfort, but because the overstraining of old eyes is thought to be one of the causes of a most serious and fatal disease of the eye.

RECAPITULATION.

In the preceding pages an attempt has been made to set forth, as simply and clearly as possible, certain facts of general interest

other respects, they mean nothing. Any one can see them by looking at the sky or a white wall through a pin-hole in a card.

Color-Blindness is a peculiar affection which, while it may be caused by disease, is generally congenital. Sight for ordinary purposes is of normal acuteness, but certain colors, most commonly red or green, cannot be correctly distinguished. It is very much more frequent among men than women (3 or 4 per cent. to much less than 1 per cent.). Practically, it is interesting and important in its relation to the employees of railways and steamboats, who are governed by colored signals. The question of life and death being involved in the correct reading of the signals, all such employees should be carefully tested in this respect before being taken on.

Accidents and Injuries.—Certain wandering denizens of the air, such as moths, cinders, gnats, etc., frequently find their way into the eyes, and few of us have not felt "what small things are boisterous there." Entering with comparatively little force, they are not imbedded in the tissues, but are usually found lying between the ball and one or the other lid, generally the upper. This being so, they are sometimes very easily removed by pulling down the upper lid over the lower, so as to wipe the under surface of the former by the lashes of the latter. Failing in this, it is not worth while to waste time on flaxseed, the popular remedy—which acts, if at all, by getting between the lid and ball, lifting it off, thereby giving the tears a better chance to wash the foreign body out—as prompt relief can nearly always be secured by a little simple manipulation on the part of a friend. It is done in this way: Place the point of an ordinary lead-pencil or other small rod horizontally on the upper lid about half an inch from its edge; grasp the lashes firmly with the other hand, hold the pencil steady, tell the patient to "look down," and just as he does so turn the lid quickly over the pencil, and, nine times out of ten, you will find the mote or cinder sticking to it. Having found it, wipe it gently off with either a handkerchief, a twisted piece of paper, or, best of all, a small soft brush made by wrapping a little cotton around the end of a match.

Workers in metal and stone are liable to more serious invasions

by flying fragments of the material in which they work. These minute pieces of steel or stone fly off with so much force that very often they are imbedded in the clear front of the ball. An attempt may be made to remove them with the brush just spoken of or with a bluntly and smoothly-pointed stick of soft wood; but if it is not easily and quickly done a more skilful hand should be sought, as repeated efforts might seriously damage the transparent cornea. Prevention being better than cure, such artisans should always wear while at work strong eye-protectors.

Quite often these foreign bodies are of sufficient size, and strike the eye with force enough, to penetrate its walls and let out some of its humors, the most common being fragments of gun-caps and splinters of wood which fly up in chopping. Injuries of this character are of such serious import that no intelligent person would fail to shift, as soon as possible, the responsibility on his medical attendant. There is sometimes in these cases a special reason for seeking his help. If the cut through the coats lie in what is called the "dangerous region," which is a belt of the white of the eye about one-eighth of an inch wide lying immediately around the colored part, and especially if the missile be still within the ball, there is great danger of exciting in the sound eye the dreaded sympathetic disease, which, when once established, is practically hopeless, causing nearly always complete and irremediable loss of sight.

Not seldom the eyes are injured by caustics of one kind or another, the most frequent being unslaked lime in fresh mortar. In such cases a little castor or sweet oil should be immediately dropped into the eye, and then the lime washed out with water.

TESTS OF VISION.

In the types below numbered 1 and XX. we have the tests respectively for near and distant vision. The perfect eye should distinguish No. 1 at one foot, and No. XX. at twenty feet, the retinal images of the two being of the same size at those distances.

The power of accommodation being normal, No. 1 should be read, with an effort, as near as three inches at the age of ten; four inches at twenty; five and one-half at thirty; and eight

at forty. When this "near point" recedes beyond nine inches, which it usually does about forty-five, it is time to put on spectacles. The rule for their selection is simply, in a few words, to put on a convex glass strong enough to bring it up again to nine inches. If nearer than that the glass is apt to be uncomfortably strong, while if it is not brought within ten inches it is not likely to afford complete relief, especially at night, when a rather stronger lens is needed than will answer under the brilliant illumination of daylight.

A person who can read No. XX. at twenty feet, and cannot read No. 1 as near as he ought at his age, is almost certainly moderately far-sighted.

One who can read No. 1 as he ought, but cannot make out No. XX., is moderately near-sighted. If No. 1 be very distinct at a nearer point than one foot while distant vision is very bad, the person has myopia of a higher degree.

One who can distinguish neither at the proper distance is either astigmatic or very far-sighted—or over-sighted, as now appears to be the better term—or very near-sighted. In astigmatism and far-sight both near and distant vision are relatively much the same, equally good or bad. In high degrees of near-sight distant vision is proportionally very much worse.

No. 4.*—Nonpareil.

The place of our retreat was in a little neighborhood, consisting of farmers, who tilled their own grounds, and were equal strangers to opulence and poverty. As they had almost all the conveniences of life within themselves, they seldom visited towns or cities in search of superfluities. Remote from the polite, they still retained the primaeval simplicity of manners; and frugal by habit, they scarce knew that temperance was a virtue. They wrought with cheerfulness on days of labor, but observed festivals at intervals of idleness and

XX.

Y A C E G L

*No. 1 is Brilliant type, one-fourth the size of Nonpareil, which is the smallest the printer has. Allowance must accordingly be made.

THE CARE OF THE EARS.

Considering man merely as a constituent element of the community, deafness is not so serious as blindness; but in its relation to the happiness of the unfortunate individual it is generally regarded by those having opportunities of observation as the worse of the two.

The deaf never receive the sympathetic consideration universally accorded to the blind on account of their physical helplessness, but, on the contrary, are often treated with impatience, if not with positive harshness. In addition, they are frequently harassed by subjective sensations—noises of various kinds "so exquisitely distressing," says Politzer, the greatest authority on the ear, "as to undermine often both the physical and moral powers of the individual, and in some cases even to lead to suicide." Their dispositions suffer in consequence, and they are apt to become sensitive, suspicious and reserved. This is peculiarly the case with those who lose their hearing in childhood while their moral natures are even more soft and pliant than their physical bodies. So deafness is very much more of an affliction than those with good hearing are prepared to admit.

The ear is made up of three divisions: a sound-collecting, a sound-transmitting, and a sound-receiving apparatus.

With the first of these every one is familiar in the peculiarly-shaped external ear or auricle. The waves of sound, having been collected by this, traverse the auditory canal, which is about an inch and a quarter long, and fall upon a delicate membrane stretched tightly across the inner end of it. This, in ordinary conversation, is often spoken of as the "drum of the ear," but it is, in fact, only the drum-*head*, or tympanic membrane, the drum being a cavity with other parts in addition. Fastened to the inner surface of this drumhead is the first of a chain of three tiny bones, called the hammer, the anvil, and the stirrup,

from their resemblance to those objects, united, as other bones, by joints (which sometimes, like them, become stiff) that extend across the drum-cavity. The end of the last one, the foot of the stirrup, fits into an oval hole in the inner bony wall of the drum, which is the outer wall of the labyrinth. It lies immediately in contact with the fluid filling the labyrinth or inner ear, the sound-receiving apparatus, in which fluid the ends of the nerve of hearing are bathed.

The waves of sound striking against the taut drumhead, it is thrown into vibrations, and these vibrations are transmitted through the chain of bones to the fluid, and through that to the nerve. This, in brief, is the mechanism of hearing.

Connecting the drum with the throat is a small and crooked tube, about an inch and a half long, called the Eustachian tube. This tube, as well as the drum itself, is lined with the same mucous membrane that covers the throat. Indeed, the drum is, anatomically considered, an off-shoot from the throat. Such being the case, we would naturally expect the drum to suffer with the throat in disease. And the facts bear out the anticipation. Fully three-fourths of all cases of deafness are attributable to affections of the drum or conducting apparatus that are almost invariably associated with similar disease in the throat. Although persons hard of hearing may not complain of the throat, it very rarely happens that trouble cannot be found there if looked for. When we remember how exceedingly common colds and sore throats are, bearing in mind that the back part of the nose is a part of the upper throat, into which the Eustachian tubes enter, it is very evident why this form of deafness is so frequent.

Inflammations of mucous membranes are always accompanied by swelling or a discharge of mucus, generally both; and, keeping these facts in view, it is very easy to understand how these troubles cause deafness. The purpose of the Eustachian tube is to keep the drum full of air, and Nature has provided that it shall open every time we swallow or yawn, so that the air may enter easily if there be need for it. You have, no doubt, often

felt the air rush into the ears when blowing your nose violently, and felt a roaring in them when gaping widely.

Sometimes in fresh colds the membrane surrounding the mouth of the tube becomes so swollen as to close it, or it becomes stopped by a plug of mucus, and then deafness results, because the air in the drum is partially absorbed and cannot be replaced. In these cases, when the tubes are opened, the restoration of hearing is often magically instantaneous. It occasionally happens that hearing suddenly returns of itself with a sudden snap. The swelling, however, is not always, or even generally, restricted to the *mouth* of the Eustachian tube, but involves the length of the tube and the drum itself. Of course swelling in these situations, and especially the presence of a viscid fluid in so delicate an instrument as the drum, must seriously interfere with its proper working. In the acute forms of these troubles relief can generally be afforded, but when they are allowed to become chronic the changes in the tube and drum often assume a permanent character, and complete restoration to hearing is then impossible.

The moral to be drawn from this is, that deafness should be treated promptly in the beginning, before irreparable damage is done. This is peculiarly true of these troubles occurring in children, as they are then exceedingly amenable to treatment, while their neglect is liable to eventuate in permanent impairment of hearing.

In this connection it is proper to make a suggestion to teachers in regard to deaf children. They are necessarily at a great disadvantage on account of their infirmity, and are often accused of stupidity or inattention when the truth is they cannot hear. So, whenever there is any reason to suspect such a thing, carefully test the hearing by conversation across the room with the child's back to you, beginning with a whisper and gradually raising the voice, making him repeat each word after you. Ascertaining those who are deaf, seat them nearest to you, and *be patient with them*, remembering that one of the frequent results of deafness and its accompaniments is an injurious effect upon the disposition, and that probably, under similar circumstances, you would not be amiable.

other changes are often associated with this accumulation, which will need attention.

Insects of various kinds frequently get into the ear, and by scratching the exquisitely sensitive drumhead with their claws, often cause frightful pain and the most terrific noises. (I was called from my bed early this morning to relieve marked distress occasioned by so harmless a thing as a common house-fly). When the presence of an insect is suspected, the ear should be filled with warm water, which will either run him out or drown him.

Foreign bodies, such as beads, peas, cherry-stones, etc., in the aural canal "should never be touched by incompetent hands." If they cannot be shaken out by jarring the head, the aid of an expert should be obtained, as a number have lost their lives from badly-directed attempts to remove them.

Injuries to the ear, through rupture of the drumhead, sometimes result from the violent concussion due to a loud explosion, as of a large cannon. Now and then it is a consequence of a concussion of a more homely and every-day character—to-wit, a box on the ear. As "there are a few well authenticated instances of death having occurred from this barbarous custom," it is superfluous to add that it is "more honored in the breach than in the observance." The drum is sometimes injured by sharp instruments, such as hairpins, knitting-needles, toothpicks, etc., and my reader is warned against scratching the ear in any such way. Never put any instrument in the ear, except your finger; you cannot get that deep enough to do any harm.

Before concluding, I must again direct attention to the importance of looking after those every-day troubles, earache and "rising in the head." To their neglect are attributable a great many cases of incurable deafness, and some of death.

North Carolina
of health. Re

NAME